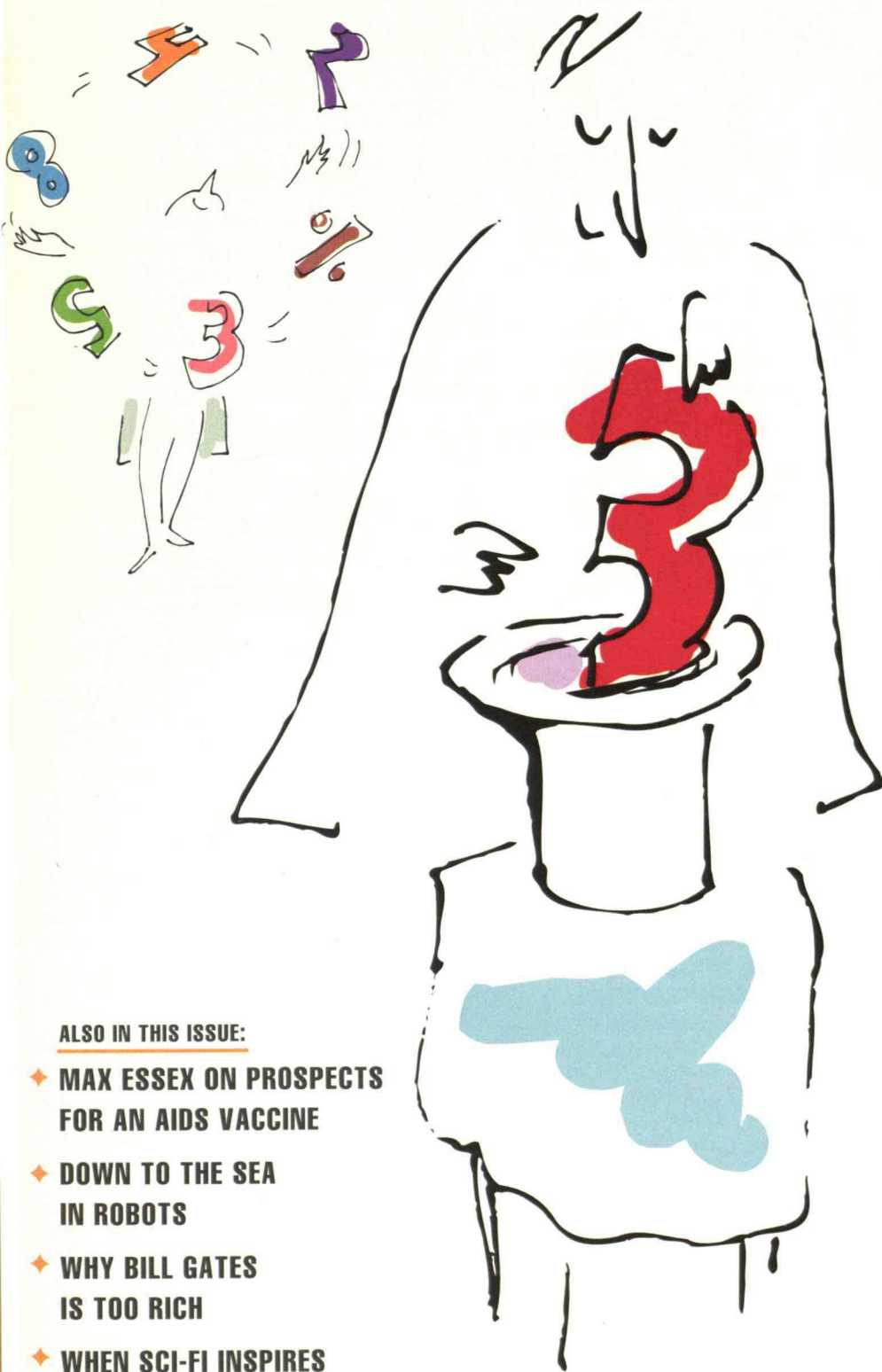


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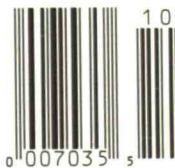


How Numbers Can Trick You

*The Six
Deadly Sins
of Statistical
Misrepresentation*

ALSO IN THIS ISSUE:

- ♦ MAX ESSEX ON PROSPECTS FOR AN AIDS VACCINE
- ♦ DOWN TO THE SEA IN ROBOTS
- ♦ WHY BILL GATES IS TOO RICH
- ♦ WHEN SCI-FI INSPIRES REAL SCIENCE



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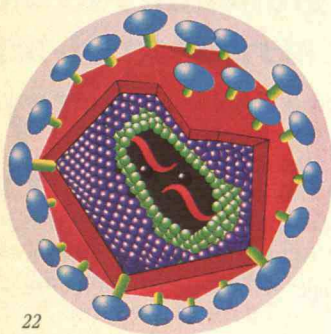
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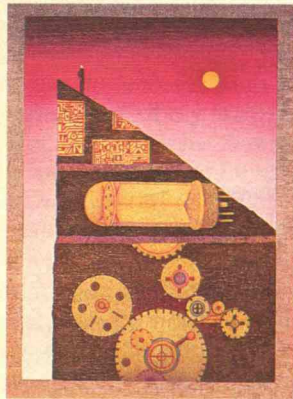


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BY MAX ESSEX

Although HIV, the virus that causes AIDS, has proven an extraordinarily elusive foe, researchers are devising innovative ways to prevent its growth. Still, because HIV mutates so quickly, numerous vaccines will be needed to defeat the proliferation of the disease in different parts of the world.



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Entrepreneurs such as Microsoft's Bill Gates often appropriate vast riches for themselves, though their individual contributions are actually modest: we all stand atop a Gibraltar of knowledge, accumulated over generations and contributed to by numerous people, that provides most of the basis of present-day advances. Communities are now experimenting with a variety of mechanisms that allow citizens to better share in the resulting wealth.



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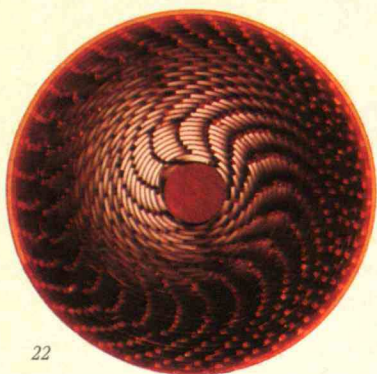
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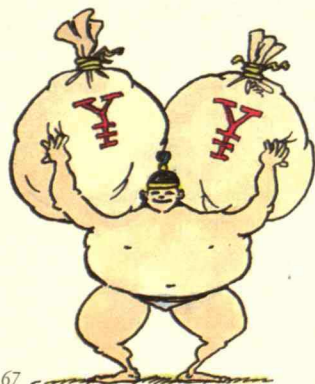
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First Line

One of Publishing's Best-Kept Secrets

WHEN I was a kid in Brooklyn, New York, during the 1940s and '50s, to be skinny was a curse. Connoting undernourishment, weakness, ineffectuality, and poor long-term prospects, thinness was something to grow out of as soon as possible or, better yet, to strenuously avoid in the first place. By contrast, to be *zaftig* (a Yiddish word I interpreted as "pleasantly plump") was a sign of robustness, attractiveness, and staying power.

"He has no *tuchess*" (only a wisp of a rear end), one of my father's friends once lamented about his skin-and-bones young son. If the poor boy had little to sit on—no bottom to build on—how well could he fare in this ruthless world?

In the magazine business, we have a similar though slightly less colorful image. It is the "tripod" of the three elements—editorial content, circulation, and advertising—that are essential to a magazine's health. If any of these legs are short or fragile, the tripod either cannot stand or leads a precarious existence.

At *Technology Review*, two of the legs are extremely strong. The editorial content is well regarded by readers and journalist colleagues alike, who find it not only timely and informative but enjoyable to read. And the circulation—the roster of subscribers—is rock solid. The magazine is not quite so strong, however, when it comes to advertising. Without more of it, we are literally too skinny. And because this translates into insufficient income to cover costs, it's a matter of some importance over the long term that we round out that *tuchess*.

Easier said than done. Though *Technology Review*'s circulation is a respectable 100,000, and much of this audience is very well-educated, affluent, and influential—just the kind of people advertisers love to address—we are, compared with the mass-circulation magazines, what's known in the trade as a "small book." Unfortunately, small begets skinny.

Remember that old joke about the drunk fruitlessly searching for his keys under the street lamp? He lost them elsewhere, he explains, but the lamp is where the light is. Similarly, to the media buyers on Madison Avenue, the big books are the universal outlet of choice because that is where the largest audience is.

This rigid mindset applies even if the advertiser, product, or service appeals only to a small percentage of that audience, which can be found with higher density—and might respond more fa-

*We may be small
by Madison Avenue
standards, but you get
a big bang for the buck.*

vorably—in smaller and more sophisticated venues better attuned to their own needs and style, and at far lower cost. In particular, the upscale demographics and purchasing power of *Technology Review*'s audience, together with the magazine's relatively modest advertising rates (the price of one full-color page in one issue of *Newsweek*, for example, buys almost three years' worth of the same ad in *Technology Review*), makes it a truly cost-effective buy.

But I cannot lay all the blame on the unreceptiveness of advertising executives preoccupied with first-tier, *Fortune* 100-type accounts. We in smallbookland also tend to search under that proverbial street lamp ourselves by targeting the biggest companies. There, we assume, is where most of the money is. That's true, of course, but little of it is earmarked for us, and if we do occasionally get in the door, we're last in and first out. Meanwhile, thousands of "second-tier" companies—smaller than the biggest guys but not small, and with nonastronomical but nontrivial advertising budgets—could find *Technology Review* to be just what the doctor ordered.

We need to direct much of our advertising-sales efforts to these and related

strategies, well tailored to our niche and inherent strengths. But therein lies another self-perpetuating problem: our resources are modest. In the magazine business, as in any other, it takes money to make money. Because we are based not at a company (much less one in the publishing business) but at a university—an entity that breathes great intellectual energy into the enterprise but is obliged to put higher spending priority on more traditional academic pursuits—we face a tight limit on the money we can invest.

So we could use a little help from our friends. If you, dear reader, are convinced by the above remarks that *Technology Review* may indeed be a highly rewarding medium (and available at a real bargain) for some of your organization's advertising efforts, and you are in a position to make or recommend such decisions, we ask that you act. Helping to make the magazine a little more *zaftig* would not only be useful to us and a value to your colleagues but a service to fellow readers: matching advertisers and audience is a benefit that cuts both ways. Needless to say, our associate publisher Peter Gellatly and his business staff will be happy to assist.

Our institutional parent, MIT, does not put out *Technology Review* to make a financial killing. Its motivations are largely altruistic, involving service to the public. Even the small self-serving component of its support, I believe, revolves around image enhancement more than the hope of long-term monetary reward. Yet although the intangible benefits of publishing the magazine may be vast, they are difficult to measure; meanwhile, the costs are easy to measure.

Though substantial dollar profit is not necessarily the goal, neither is a negative balance sheet. As Tevye, the earnest but struggling milkman in *Fiddler on the Roof*, observed, "It's no shame to be poor. But it's no great honor, either." At the very least, to paraphrase the time-honored rule of that ivy-covered institution down the street, "Every tripod on its own bottom." ■

—STEVEN J. MARCUS

Holiday Gift Ideas!

from Technology Review

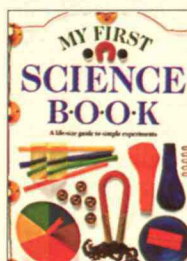


Technology Review books explore and explain, fascinate and delight. Readers young and old will welcome these carefully chosen titles to their library—as well as the learning that only great books can give!

My First Science Book

by Angela Wilkes

Kids can learn about the weather by making a rain gauge, barometer, and wind vane, or test acidity and alkalinity with their own litmus test. Includes instructions with color photographs, and clear explanations of why things happen. Over a dozen experiments.

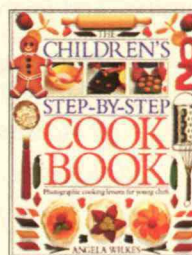


Ages 6–10, Hardcover, 48 pages, \$13.00

The Children's Step-by-Step Cookbook

by Angela Wilkes

The first cooking course for aspiring young cooks, with page after page of mouth watering dishes. More than 50 easy-to-follow recipes that are fun to make and delicious to eat! Clear step-by-step photographs show each stage of the recipe. Beautiful photographic cooking lessons.

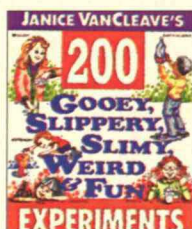


Ages 4–12, Hardcover, 128 pages, \$18.95

200 Goopy, Slippery, Slimy Experiments

by Janice VanCleave

Zany, wacky, entertaining, this book engages children's imaginations while answering their favorite questions about the environment. Your kids will have so much fun conducting these 100% fool-proof experiments they'll forget they're learning.

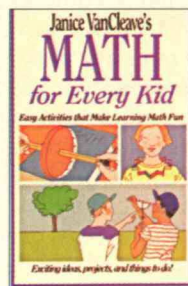


Ages 8–12, Paperback, 113 pages, \$12.00

Math for Every Kid

by Janice VanCleave

Easy activities that make learning math fun! Packed with illustrations, *Math for Every Kid* uses simple problems and activities to teach kids about measurements, fractions, graphs, geometry figures, problem solving and more!

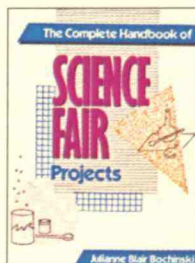


Ages 8–12, Paperback, 215 pages, \$10.95

The Complete Handbook of Science Fair Projects

by Julianne Blair Bochinski

The only book you'll need for selecting, preparing, and presenting award-winning science fair projects. Written by a veteran contestant and judge, this step-by-step guide describes 50 projects in detail and suggests 500 other topics suitable for grades 7 and up.

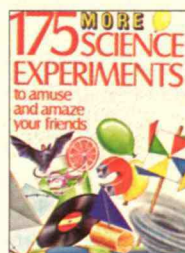


Ages 12 and up, Paperback, 206 pages, \$12.95

175 More Science Experiments

by Terry Cash, Steve Parker, & Barbara Taylor

A sequel to the popular *175 Science Experiments*, this book brings further enjoyment to curious kids. Within four main sections—Sound, Electricity, Simple Chemistry, and Weather—it provides a lively menu of experiments, tricks, and things to make.

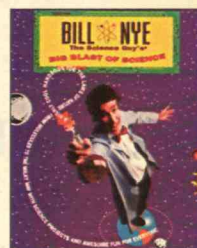


Ages 8–12, Paperback, 172 pages, \$12.00

Bill Nye The Science Guy's Big Blast of Science

by Bill Nye

A highly cool handbook for the laws of nature from molecules to the Milky Way. With science projects and awesome fun for everyone. Bill Nye the Science Guy knows how cool science can be! After all, everything in the universe involves science. You already think scientifically every day, even if you don't know it!

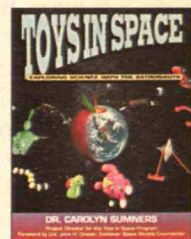


Ages 10 and up, Paperback, 171 pages, \$12.95

Toys in Space

by Dr. Carolyn Sumners

Filled with dozens of toy-building activities that simulate experiments NASA astronauts perform on space shuttle missions.

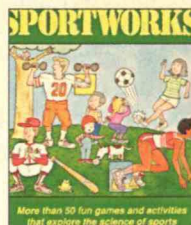


Ages 12 to adult, 78 pages, \$10.95

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by the Ontario Science Centre
Illustrated by Pat Cupples

Why does a curveball curve? What makes a good football helmet? How do figure skaters spin so fast, and don't they get dizzy? You find answers to these sports mysteries and much more in this fun-filled book by the world-famous Ontario Science Centre.

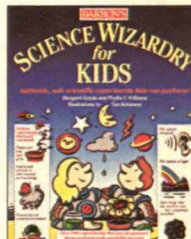


Ages 8–12, Paperback, 96 pages, \$8.95

Science Wizardry for Kids

by Margaret Kenda & Phyllis S. Williams

More than 200 authentic, safe experiments that use everyday, inexpensive materials. Kids will get to know the thrill of discovery by looking at their immediate world: making toy boats, brewing sun tea, growing violets, collecting rocks. Includes step-by-step instructions and glossary.



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Letters

THE MYTH OF THE DEFENSE GHETTO

In "Why Defense Reinvestment Won't Work" (TR July 1994), Bruce Berkowitz defines defense reinvestment in such a way that nobody could make it work. The Clinton administration is not trying to "use the existing defense industrial base as the spearhead for economic growth." What we are trying to do is break down the barriers between the military and commercial sectors that Pentagon rules and defense-procurement policy have built up over the past few decades, so we can maintain our technology-based military advantage with a much smaller defense budget. Dual use is not a strategy for "defense conversion," as the author suggests. Rather, it is a strategy for allowing DOD to draw more easily from the commercial sector to meet defense needs.

For example, the Department of Defense's Flat Panel Display Initiative, designed to foster a *commercial* U.S. display industry, is part of this strategy. By targeting investments in information technology, advanced manufacturing, advanced materials, and other areas, DOD is ensuring that commercial firms in this country can supply defense needs with leading-edge technologies at affordable costs.

The Technology Reinvestment Project is another part of this strategy. The TRP offers firms the opportunity to develop technologies that have both commercial and military applications. Eighty percent of the winning teams in TRP are partnerships between defense and commercial companies. Although defense stands to gain the most from the dual-use strategy, the civilian side of our economy will benefit as well. Certainly, DOD spending is small in relation to our whole economy, but it has a disproportionate effect since it is heavily weighted toward fostering leading-edge technologies, many of which will help to strengthen our commercial industries and, down the road, lead to the creation of high-quality jobs.

Berkowitz is on target in observing

that the federal government's needlessly cumbersome acquisition system is the greatest barrier to commercial-military integration, but he neglects to mention that, despite failures in past administrations, we are making progress in streamlining acquisition laws. The Senate recently passed legislation to reform the acquisition system, and the House is expected to take similar action soon. Moreover, DOD is aggressively eliminating unnecessary military specifications and standards in favor of commercial counterparts. There is more to do, but this is a substantial beginning.

President Clinton's defense reinvestment policy also includes first-class reemployment and retraining assistance to workers who lose their jobs at closed-up defense plants or shut-down military bases; a range of programs to help departing service men and women make the transition to civilian life, from the traditional GI Bill to the new "troops-to-teachers" and "troops-to-cops" opportunities; and redevelopment assistance to communities that have relied on defense spending for their economic livelihood.

Finally, the best defense transition strategy is a comprehensive one. This means government investments in things such as world-class education and training for all our children and workers, sustained support of fundamental research, technology extension services to help small businesses perform better, and partnerships with industry to develop commercial as well as dual-use technologies—thus fostering the growth of the knowledge-intensive, wealth-generating industries that are the source of good jobs and rising standards of living for all of us.

JOHN H. GIBBONS
Assistant to the President
for Science and Technology
Washington, D.C.

Berkowitz argues that defense workers with specialized skills will be able to magically find employment in the commercial sector after their defense employers collapse. This contradicts the

rest of his argument, in which he claims that defense-industrial skills are not easily adapted to harsh commercial realities. If the latter is true, then programs like the Technology Reinvestment Project may be effective tools for easing defense firms and their workers into the commercial sector.

MICHAEL TOPPA

ERIK PAGES

Defense Transitions Project

Business Executives for National Security
Washington, D.C.

Bruce Berkowitz's arguments concerning defense reinvestment policies are based on a distorted though common view of the defense industrial base. Berkowitz believes that defense companies are "hopelessly ill-suited for competing in commercial markets" because their management and organization are incompatible with the skills, knowledge, and culture needed to compete commercially.

This is an old and tired refrain that simply overlooks most of the firms in the defense industrial base. Although 100 defense contractors receive about two-thirds of defense prime contract awards, they pass a huge portion of those funds right through to subcontractors. Lockheed Fort Worth, Allied Signal, and Pratt & Whitney, for example, all estimate that they purchase 60 to 70 percent of the value of their output from suppliers. And this supplier base is vast. According to data from the U.S. Census, there are tens of thousands of facilities doing defense-related work, including half of all U.S. durable-goods manufacturers.

What's more, despite Berkowitz's unflattering comparison of defense firms with Ford and Honda, mass consumer markets are hardly the only kind of commercial market. Mack Truck and Cincinnati Milacron sell hundreds or thousands, not hundreds of thousands, of any particular model truck or industrial robot and would have as hard a time competing with Honda in mass markets as Lockheed would.

Berkowitz points to a few high-profile

cases where defense work is cordoned off from commercial manufacturing, but this unfairly belittles the technical and managerial skills of most establishments. At GE Aircraft Engines, commercial and military engines share management, inventory, R&D facilities, and manufacturing workstations. So too, Hewlett-Packard's Microwave Semiconductor Division, Hughes Aircraft's satellite operations, and Wyman-Gordon Co.'s Casting and Forging Division all integrate commercial and military production. These are some of the most commercially successful companies in America. Even Texas Instruments' mostly segregated Defense Systems and Electronics Group operates a production line for application-specific integrated circuits that sells half of its output to commercial customers.

As Berkowitz says, defense procurement makes up only a small percentage of the national economy. Thus, the tens of thousands of facilities in the defense industrial base cannot all be doing anything close to 100 percent defense-related work. Policy wonks on both sides of the conversion debate might begin to find common ground if they'd stop perpetuating the myth of the defense ghetto.

TODD A. WATKINS

Department of Economics
Lehigh University
Bethlehem, Pa.

Bruce Berkowitz is correct in stating that the nation should not invest "heavily in the defense sector to produce new job-creating economic growth." I would have been blunter. The federal government should not invest at all in the military-industrial sector in a futile effort to produce new job-creating growth. When automobiles became popular, manufacturers of wagons either adapted or went out of business. There is no point in trying to save obsolete industries, whether equine-powered or military-powered. Unfortunately, Congress finds it difficult to allow these industries to be phased out because it fears new industries will not move in to replace them.

But in Lebanon, Pa., where I grew up, steel mills, textile-knitting mills, and shoe and shirt factories closed after World War II. Today there is little unemployment because new industries are now taking advantage of that productive workforce.

WARREN HIMMELBERGER

Wellesley, Mass.

A NEW GENERATION ON ROUTE 128

For the past 25 years, I have pursued my career in New England at three of the firms Annalee Saxenian mentions in "Lessons From Silicon Valley" (*TR* July 1994): Digital Equipment, Apollo/Hewlett-Packard, and Data General. I have also spent many hours in Silicon

Valley as a developer, manufacturer, and employee. In my experience, Saxenian's hypothesis—that

the cultural and social differences between "laid back" California and the "buttoned-up" East Coast

are the underlying cause of Silicon Valley's relative success—has merit.

But I would point out that companies such as Digital, Prime Computer, and Data General had no alternative but to develop proprietary technology and to remain vertically integrated during the '70s because disk drives, central processing units, high-speed memory, magnetic tapes, and operating systems were not available at any price from other firms. These pioneering companies invented both new technologies and the processes to build them.

It wasn't until the Japanese began to manufacture these components as commodities during the early '80s that West Coast companies such as Apple and Sun Microsystems could produce computer systems cheaply, since the basic "stuff" of computers was available to everyone at competitive prices. These companies had an undeniable advantage in that



they had no history to overcome or existing customers to support.

A new generation of companies is forming in the East that is learning from past mistakes and combining the best East and West Coast characteristics. Many of us at such companies have had to leave our old jobs to start or join new companies to break away from the past. What's more, regional differences such as job switching and after-work beer blasts typical of Silicon Valley will become less important or practical as these new companies form global partnerships with other companies using information technology, as my current employer is doing.

ROY J. MOFFA

Chipcom Corporation
Southborough, Mass.

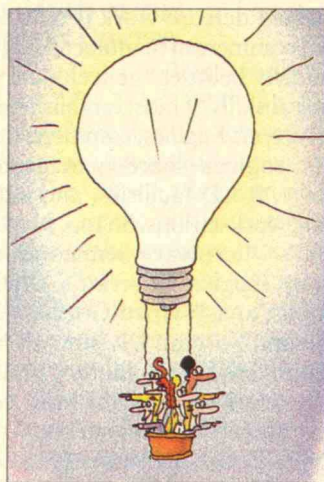
ORGANIZATIONAL TEAMWORK

"Innovation Congregations" by Tom Kiely (*TR April 1994*) leaves the mistaken impression that team product design originated quite recently in companies producing commercial goods. In fact, the team approach to development began almost a half-century ago in the military-industrial-university complex of the 1950s.

Development groups were then so large and included individuals from such heterogeneous backgrounds that the team approach—then called the systems approach—had to be institutionalized. Gen. Bernard Schriever, head of the Atlas intercontinental ballistic missile project, relied on a collective development process that involved hundreds of major contractors.

Study groups of academic and industrial engineers and scientists created the conceptual design of the SAGE air defense systems, and interdisciplinary teams at Lincoln Laboratory and elsewhere developed the second generation of Whirlwind-genre computers, computer networks, and advanced radar.

Parallel development—simultaneous pursuit of several solutions, which Kiely also describes—can be traced back to the Manhattan Project and was also commonplace in the military-funded



aerospace projects of the 1950s. At the beginning of the U.S. Navy-funded Polaris project to develop an intermediate-range ballistic missile, an interdisciplinary and interorganizational team launched propulsion, guidance, and structure sub-projects simultaneously. The complexity of managing concurrent development led the Navy and its industrial contractors to introduce computer planning and monitoring.

We too rarely acknowledge the remarkable impetus that the military-industrial-university complex gave to the development of new managerial approaches and technical problem-solving. In cooperation, the three could once again foster such innovations, especially in the realm of large-scale non-military-funded projects.

THOMAS P. HUGHES

Andrew W. Mellon Professor
University of Pennsylvania
Philadelphia, Pa.

I enjoyed Tom Kiely's article on teamwork—especially new-product development teams. Too often, such teams have been described in unrealistically positive terms, and some executives believe that teams will immediately produce positive results. The reality is that, in most cases, teams pose difficult organizational challenges and require significant time, energy, and resources.

While the transition to teams can be taxing, teamwork does offer tremendous

potential payoffs if it is introduced effectively. Improved productivity, quality, worker satisfaction, and reduced turnover and absenteeism are among the positive outcomes that organizations have enjoyed. Some might argue that they are becoming so prevalent that work teams no longer represent a real competitive advantage but simply a path that must be taken to keep up. Personally, I believe that tremendous competitive advantages are still available to organizations that prepare for and do teams well. Effective team systems require commitment, preparation, and realistic expectations.

CHARLES C. MANZ

Professor of Management
Arizona State University
Tempe, Ariz.

STRIKE LABOR UNIONS

I take exception to the notion raised in "Creating a Level Playing Field" (*TR May/June 1994*), by Richard J. Barnet and John Cavanagh, that all the good things in America come from labor unions and government regulations, and that we should force other countries to implement similar measures. Taiwan, Korea, and other Asian Tigers have prospered without the help of an extensive labor-union movement. If we really want to help Third World workers, we should encourage free markets, not "New Deal" socialist regulations.

Wages in Taiwan are 10 to 20 times higher than in China primarily because of capitalism, not because Taiwan has more labor regulations. The British economy after World War II was nearly destroyed by overpowerful labor unions. The decline of U.S. manufacturing was exacerbated by labor unions that interfered with the innovations needed for competitiveness. If we truly want a level playing field, we will allow the U.S. union movement to continue its downward spiral into the dustbin of history and begin the process of dismantling oppressive U.S. labor regulations.

WILLIAM C. HAMPTON

Houston, Tex.

NO SURROGATE PARENTS

With regard to "How Schools Are Short-changing the Gifted," by Sally Reis (*TR April 1994*): Today's educational problems stem from parents who don't take time to excite their children about learning; a television industry that is destroying our society with gratuitous violence and sensationalism; and legislators who are willing to spend vast sums on everything except education. The result is inadequately prepared and compensated teachers and truncated or dropped programs.

This country has allowed its educational system to become a surrogate parent, responsible for providing breakfast and lunch, health checkups, sex education, and moral values. Meanwhile, teachers are supposed to be innovative and entertaining as they try to teach our children everything they need to know to "make it" in a competitive world. It is an impossible task, and we make it harder when we tell our educators, as Reis does, that they're doing a lousy job. We must insist that parents do their job, which means preparing their children for the discipline of learning.

MARY E. KELLY
Groveland, Calif.

Sally Reis fails to mention a group of people who are making a significant difference in educating gifted children—their parents. Almost half a million children in the United States today are schooled at home, where they are offered virtually unlimited opportunities to pursue their interests, reach new creative heights, and expand their minds beyond the rigid boundaries of the classroom. Today's home-schooled students can work individually, in groups and co-ops, and even in cooperation with the public and private schools. These children achieve high scores on standardized tests, and a growing number of home-schooled students are entering prestigious colleges and universities. As the truth about the declining state of our nation's schools filters out to the public, home-schooling is rapidly becoming an attractive option for meeting the needs of one of our nation's most important natural resources.

CHRISTINE HANNAH TABAK
Mount Vernon, Iowa

GARBAGE IN, GARBAGE OUT

The very points being made in "Simulations on Trial" (*TR May/June 1994*), by Arielle Emmett, were inadvertently illustrated by the article's own inaccuracies. In referring to the 1985 Dallas/Fort Worth airline crash, the author says it "killed all 137 people on board," while the National Transportation Safety



Board (NTSB) said "of the 163 persons aboard, 134 passengers and crew members were killed; 26 passengers and 3 cabin attendants survived." The 135th victim was the driver of the car on the highway north of the airport.

Equally casual—but not precisely factual—is the statement that the plane "rolled violently across the airfield," when the NTSB reported: "The airplane struck the ground about 6,300 feet north of the approach end of Runway 17L, hit a car on the highway—struck two water tanks on the airport, and broke apart." It slid but did not roll.

These trivial inaccuracies are cited not simply to point out errors, but because they exemplify the very point made by the author that simulations "often reconstruct versions of reality that may not represent the truth," and "the potential for distortions of computer animations is enormous."

WILLIAM H. HAGGARD
Asheville, N.C.

POOR INCENTIVES FOR EDUCATIONAL TECHNOLOGISTS

Langdon Winner's accurate portrayal of glitz in educational technology (*"The Virtually Educated," TR May/June 1994*) strikes squarely at the principal barrier to progress in that field. Those most qualified to provide "intellectual nourishment" through electronic means

are least likely to do so, since academics who devote serious time to developing educational technology meet with lack of support, peer disapproval, and professional stagnation—poor incentives for a young PhD with ambition and a mortgage.

In his "Technology Initiative" address in February 1993, President Clinton predicted a "new generation of educational hardware and software" that would make a "revolutionary difference in the classroom." For that effort to surpass the "electronic frosted flakes" noted by Winner, the academic establishment must accept the development of teaching software

as a bona fide scholarly endeavor, on an equal footing with more traditional research, subject to peer review and publication. Otherwise we commit a vital component of modern education to those least able to implement it or to commercial interests.

KENNETH R. JOLLS
Chemical Engineering Department
Iowa State University
Ames, Iowa

Langdon Winner's criticism of the young is a dangerous pastime embodied in the classic, "When I was a boy, we had to trudge 20 miles in the snow..." If Einstein was legendary for not memorizing things he could look up, who are we to criticize today's channel surfers? CD-ROM and on-line data searching provide students with a great deal of information obtainable in far fewer hours than ever before.


Many of today's students are modern Martin Luthers, reforming education's sacred cow—the university. Whether one views technology as a miracle or a monster, the university is no longer the sole crucible of learning. If Luther advocated a faith without priests, technology provides knowledge without professors. These new coins may not be "counterfeit," as Winner argues, but rather a different currency.

PETER C. VERBICA
San Jose, Calif.

Continued on page 71

MIT Reporter

ENHANCING AIR-TRAFFIC CONTROL INFORMATION

 The job of an air-traffic controller is filled with constant tension and requires absolute vigilance. Simply by staring at blips on a green radar screen largely designed 50 years ago, a controller has to apply a great deal of knowledge and make numerous mental calculations to ensure that several to dozens of aircraft are traveling safely in their proper flight paths.

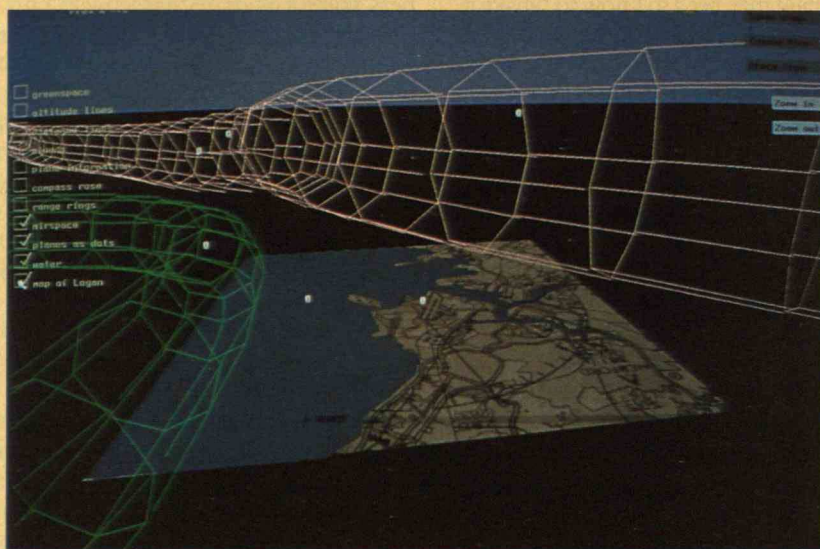
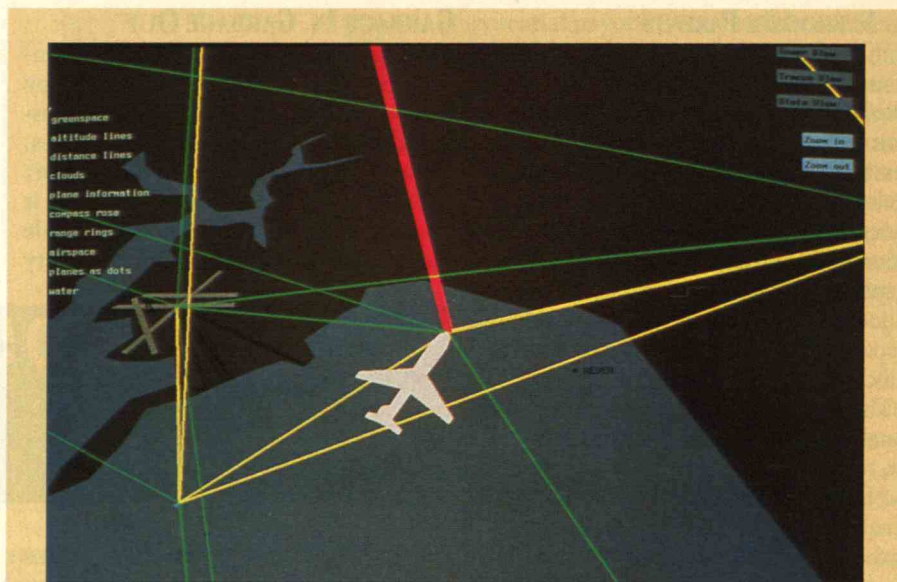
Life could get easier for such harried workers in a few years if "proof-of-concept" work on a new computer display leads to adoption of a radar screen that presents more information in a simpler fashion. The designers of the display, members of the MIT Media Laboratory's Visual Language Workshop, have worked to minimize visual clutter and make important information stand out.

The focus is on allowing users to look "at all the data but not be overwhelmed by it," says Ronald MacNeil, principal investigator for the project.

One significant feature of the new display is a graphic representation of each airplane's assigned airspace—the theoretical "highway in the sky" it is supposed to be following. By highlighting the three-dimensional boundaries of this space—making it appear as a ghostly tunnel marked by a color contrasting with that used to note locations of the planes themselves—the display makes it instantly obvious if an aircraft is deviating from its assigned path.

Another important feature, according to Jeffrey Ventrella, the graduate student who was the system's key designer, is that it allows the controller to quickly shift the perspective depicted on the screen—changing to a side view and revealing an airplane that had been hidden behind another, for example. The controller can easily control the height and angle from which an aircraft is viewed by moving a computer mouse.

And controllers can click the mouse to activate perhaps the most critical new visual information: lines showing the distance between each pair of planes on



A new computer-display system for air-traffic controllers uses colored lines to indicate the relative distances between airplanes (top). The red "emergency alert" line indicates that an airplane is dangerously close to another one (not

shown), yellow lines serve as warnings, and green lines indicate all is well. The system can also depict the three-dimensional corridors through which planes, marked as dots in the image immediately above, are supposed to fly.

the screen. If the distance drops below a certain threshold, a line becomes thicker and more noticeable. Closer yet, and the line turns yellow. And if the two planes are so close that there is danger of a collision, the line turns red—the only red

object that ever appears on this display.

But one feature that various Media Lab visitors find particularly impressive and useful has left air-traffic controllers cold: the ability to view the screen through shuttered polarizing glasses that

allow the relative positions of the planes to appear to pop out in three dimensions. For one thing, the controllers didn't like wearing the equipment. One objected to "the sense of being immersed in the scene," says Ventrella. The person maintained that "he wanted to keep his objectivity." Also, because of the greater computational work needed to generate the stereo images, the image quality isn't great, Ventrella points out.

Leonore Katz-Rhoads, the transportation engineer at the U.S. Department of Transportation who initiated the research project, says she would also like to see visual depictions of cloud formations, air turbulence, and the relative amount of daylight so controllers can anticipate what pilots will encounter and how they may react.

In any case, she says, the next step is to come up with financing for further research to develop the system so it could be considered as a future technology for air-traffic control installations, a process that might require new hardware as well as the Media Lab software. "I'm actively seeking support" for such research now, she says.

—DAVID L. CHANDLER

ARTIFICIAL SENSATIONS

After Darth Vader lopped off Luke Skywalker's hand in *The Empire Strikes Back*, the young Jedi knight had an artificial one attached. When a robot lightly pricked one of Skywalker's new "fingers" with a needle, he yelped.

The idea of equipping an artificial hand with sensation isn't limited to science fiction. Researchers have worked for more than 20 years to develop neural prostheses, miniature devices that stimulate arm or leg nerves with electricity, thus helping amputees and others who have lost the use of limbs perform tasks. But the prostheses developed so far do not have parts that can last long in the body, and the closest any of them has come to reproducing sensations such as pressure is a finger-in-the-light-socket type of tingle.

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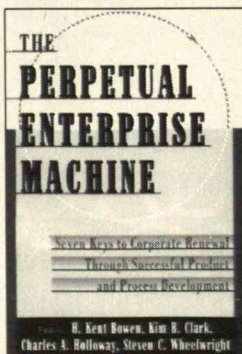
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Now Ronald Riso, a senior research associate professor with the Rehabilitation Engineering Center at Case Western Reserve University, is heading a project in which David Edell, a principal research scientist in the Department of Health Sciences and Technology at MIT, and others are trying to develop the first neural prosthesis whose parts can work reliably and safely in humans for decades.

Every act involving touch, such as picking up a cup of coffee, stretches and distorts the skin on the fingertips. This triggers thousands of packets of specialized nerve receptors just below the surface, which in turn send a stream of electrical signals—neural impulses—through some 17,000 axons, the nerve fibers that conduct impulses to and from the brain. The brain then translates these impulses into sensations that correspond to the shape, weight, temperature, and texture of the coffee cup—information that allows a person to adjust his or her grip accordingly.

Riso, Edell, and surgeons Michael Keith of Case Western and Mark Koris of the West Roxbury (Mass.) Veterans Administration Center are relying on this knowledge of the nervous system to design a prosthesis that will stimulate sensations and can attach through a tiny implant to the arm's pencil-wide median nerve, which normally supplies feeling to every part of the hand except the pinky and a portion of the ring finger.

The first step in the project has entailed developing a reliable implant

called a "neural interface," to connect a person to an electric-power source that can provide artificial neural impulses. Edell, as the group's biomedical engineer, has created a prototype interface consisting of 12 wire electrodes that protrude through a silicone cup slightly

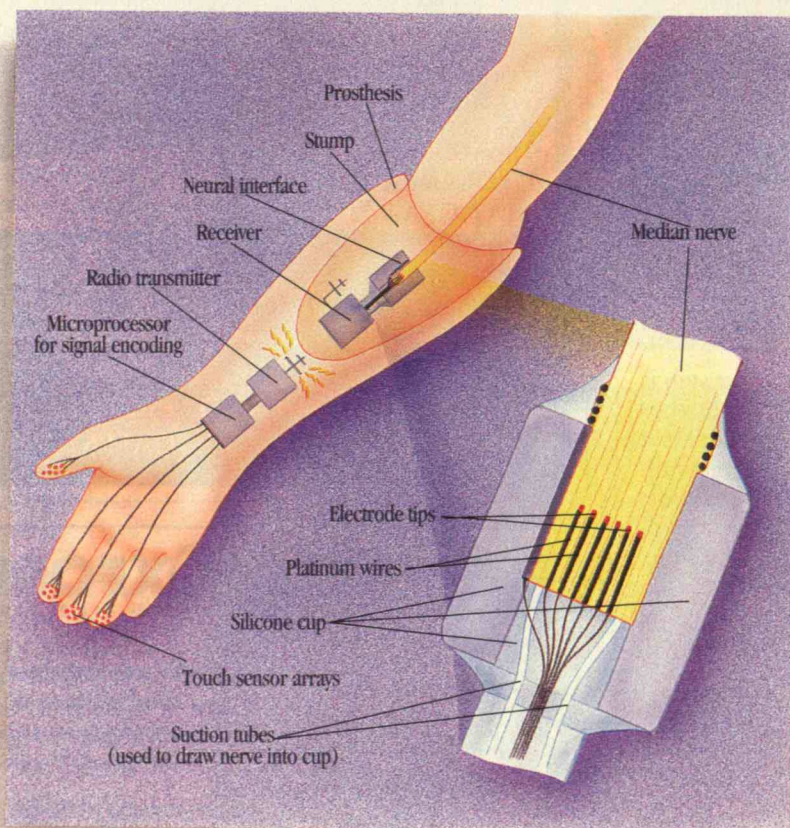
electricity source and other devices. The researchers are now testing the neural interface's safety and effectiveness in rabbits' leg nerves.

A major hurdle in developing electronic implants has been designing a device that holds up inside the body's warm, salty fluids. After studying different materials for many years, Edell chose platinum wire because of its reliability in electronic circuits and silicone because it is relatively inert in the body. He says that the type of silicone used in the device does not diffuse easily into the body, partly because it is a solid rather than a gel.

Edell has also had to consider the body's tendency to wall off foreign objects such as implanted electronic devices with layers of cells that form scar tissue. Robert Baier, a professor of biomaterials and biophysics at the State University of New York at Buffalo, says this

could block conduction of electric pulses from electrodes to neurons. Edell replies that his interface's electrodes are so thin (50 millionths of a meter in diameter) that they should be able to work their way between axons, causing relatively little trauma and scar-tissue formation.

If the researchers can prove that the interface operates safely and reliably in rabbits, they plan to implant it in people. In the proposed human studies, amputees who have had an arm removed below the elbow will have the interface attached to the median nerve at the end of their stump. Subjects will remain awake during surgery as researchers



A proposed artificial arm that would allow an amputee to feel sensations at the fingertips would rely on a "neural interface." The interface, designed to be implanted into the end of a severed nerve, was engineered to survive the warm, salty fluids in the body.

larger than the diameter of the median nerve. After doctors implant the interface into the end of such a severed nerve, the wire ends inside the cup are supposed to slip among the patient's axons. From the cup's other end, the wires attach outside the skin to a Teflon connector that in turn can be hooked to an

stimulate different bundles of fibers in the nerve with mild electric currents, allowing the researchers to determine precisely where on the nerve to implant the device.

Creating Feelings of Pressure

After subjects recover from surgery, the researchers will try to create sensations corresponding to the amounts of pressure one would normally feel in a hand when doing various tasks. A subject will sit in front of a desktop computer that will control a motor-driven pressure device touching a finger of his or her remaining hand. As the pressure device exerts force, the person will provide the computer with information on the amount of pressure he or she feels. The subject will indicate this by making movements—say, up or down—using a peripheral device such as a joystick. The computer, which will also be hooked up to the person's implant, will then translate that information into a pattern of electric pulses that will travel through the implant and create a feeling of pressure on that side. Such studies should allow Riso's team to determine the precise patterns of electric impulses necessary to create various degrees of pressure.

The next step will be to design a neural interface containing more electrodes to mimic additional sensations such as texture and temperature. The researchers plan to accomplish this by replacing the interface's wires with multiple silicon chips that each contain more than 100 electrodes. Then, finally, the team will attempt to develop a prosthesis containing the neural interface. Riso's long-term vision of a prosthesis for the hand and lower arm involves "a mosaic of sensors" on the fingertips. The resulting sensory signals will be encoded into electric signals by a microprocessor chip built into the prosthesis and sent by another built-in device, a radio transmitter, to a receiver and stimulator implanted in the remaining portion of the natural arm and, from there, to the implanted neural interface.

—KIMBERLY RIDLEY

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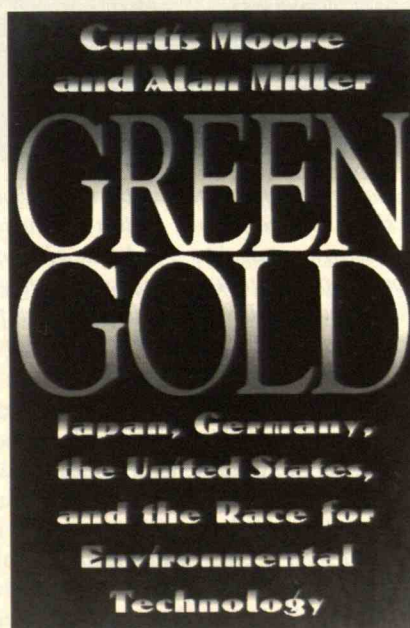
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Trends

Smart Sea Charts

Mariners are hailing it as the biggest advance in navigation technology since the sea chart. It bears the acronym ECDIS, for Electronic Chart Display and Information System, and had it been installed on the Exxon Valdez, that ill-fated tanker likely would never have run aground on Bligh Reef.

ECDIS is the latest in a long line of navigation technologies that started when the Vikings first used a notched stick held at arm's length between the midday sun and the horizon to tell if they had drifted north or south of their course since noon the day before. In medieval times, the Crusaders returned to Europe with a handy Arabic invention, the magnetic compass. In the eighteenth century, the sextant enabled seafarers to accurately measure the angle of the sun to figure latitude. And a century later the chronometer, a precise timepiece, helped them to determine longitude. Mariners used such tools to plot their position and routes on sea charts, which, by the time Captain James Cook made his historic voyages around the world in the late 1770s, included most of the features they bear today.

Our own century has seen its share of advances in navigational techniques, mostly based on radio, which made it possible to check a chronometer's readings using timed signals broadcast from a

radio station on land. Radar helped mariners determine an approaching ship's distance and direction by bouncing radio waves off the vessel. Then came Loran, or long-range navigation, a system that determines a ship's position by timing the arrival of radio pulses from synchronized transmitters at various points on shore.

Most mariners consider such advanced systems miraculous, but even DGPS leaves mariners plotting fixes on paper charts to see where they are in relation to everything around them. "By the time someone has plotted a position on the chart and looked at the situation, typically three or four minutes have passed," says Michael Casey of the Canadian

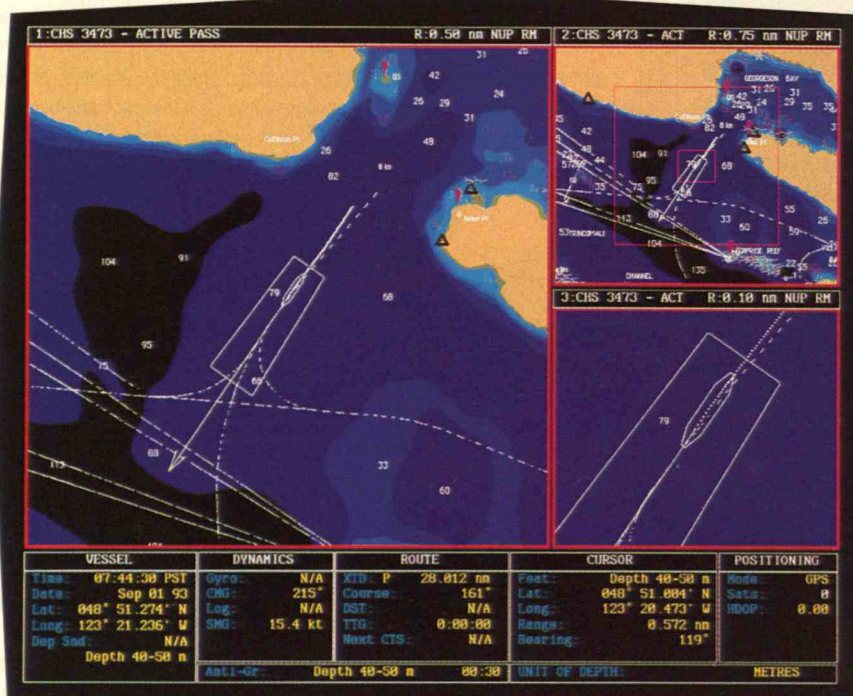
Hydrographic Service. "If you're navigating in tricky areas, that delay can lead to a lot of problems."

The method for precluding such problems stems from two complementary technologies now under development. The first is the electronic chart, which at the touch of a button displays on a computer screen water depths, coastlines, lighthouses, buoys, wharves, shoals, and all other information contained on conventional paper sea charts.

The second technology is ECDIS, which marries electronic charts with the other navigation sensors modern mariners commonly use. ECDIS continuously updates and combines information on a vessel's speed, its

position (from its DGPS or Loran system), and approaching ships and other hazards (from its radar). When the ship approaches a hazard, one or several alarms sound on the bridge.

"Most mariners we've encountered—experienced or inexperienced—see ECDIS as a benefit," says Lee Alexander, head of an ECDIS evaluation project for the U.S. Coast Guard. Even old salts weaned on dead reckoning become "almost instant converts," con-



Electronic Chart Display and Information Systems—this one shows the Georgeson Bay in British Columbia—give navigators an aerial view of their ship's position at three different magnifications. Dotted lines indicate ship routes, and numbers

in the water show depths in meters. The system automatically triggers an alarm if it detects a hazard within the rectangular box surrounding the ship. The text boxes below the charts provide exact readings of the vessel's position, course, and speed.

Next came the Global Positioning System, or GPS, originally developed by the U.S. military. Unlike Loran, which relies on land-based signals that cannot reach more than several hundred miles out to sea, GPS beams radio signals off satellites to any point on earth. It can normally determine a vessel's location to within 100 meters, but when its signals are corrected from mainland stations—a process known as Differential GPS, or DGPS—it is accurate to within 5 meters.

curs Casey, "when they look out and see that the ship is abreast of a buoy and, sure enough, on the screen it's abreast of a buoy."

The main shortcoming of ECDIS seems to be that the technology is leagues ahead of the supporting data. The pinpoint accuracy of DGPS means that many harbors will need to be resurveyed since existing charts do not have sufficient resolution. Further, electronic versions of marine charts have not yet been made for most areas.

Finally, digitizing paper charts takes time. The quickest method is to take a digital photo of the chart with a scanner and store the image on a disk. But that results in a "dumb" chart that is scarcely more useful than the paper version. The computer sees objects on such a chart only as a series of dots and cannot distinguish between different objects.

The preferred but more time-consuming and costly approach—the one that Casey's group is using—is to create "intelligent" charts by manually tracing chart data into a computer. Specialized software then helps the chart maker define objects and their attributes, which the computer can then manipulate. With such charts, a mariner could program the computer to sound a warning, for example, when the vessel approaches waters less than 10 meters deep.

The Canadian Hydrographic Service, arguably further ahead than its counterpart in any other country, has created about 300 intelligent charts from the 1,100 that exist for Canadian waters, and expects to finish the 600 most important charts within a year. The agency makes the electronic charts available to the public on floppy disks as they are completed and provides updates as needed. Germany, Norway, and Japan are also developing ECDIS systems.

Meanwhile, the United States has barely left the dock when it comes to producing electronic charts. Both the Coast Guard, which is the lead agency responsible for maritime navigation in U.S. waters, and the National Oceanic and Atmospheric Administration, which

administers hydrographic services, have urged Congress to approve funding to create electronic charts of U.S. waters. But owing to what the Coast Guard's Alexander diplomatically terms "a matter of priorities," the needed resources—\$25 million over three years—have not been forthcoming.

Eliminating the Fog Factor

"To delay the implementation of ECDIS is penny-wise and pound-foolish," Alexander says. "That amount is peanuts compared to the cost of responding to a major oil spill like that of the *Valdez*, which cost \$3 billion."

Such systems can also mean huge savings for shippers. For example, the Canadian Hydrographic Service's Casey has spent many hours testing ECDIS systems on the Great Lakes, where Canada Steamship Lines, the nation's largest shipowner, has installed prototype ECDIS systems on all 13 of its bulk carriers. He cites many occasions when ships with ECDIS entered harbors in conditions of poor visibility that would normally have stopped them cold. "A ship like that might cost \$15,000 to \$20,000 a day sitting idle," he says. "This way, they're able to keep the ship moving." For owners of large commercial ships, such savings quickly offset the initial cost of ECDIS systems, the most sophisticated of which run about \$100,000.

Alexander stresses that even those who can afford the high-end systems should consider ECDIS an enhancement, not a replacement of traditional skills or technologies. "Prudent mariners will not ignore other tools," he says, "whether they are visual, audible, or based on sensors such as radar or depth sounders."

Casey agrees. Even though the International Maritime Organization will not require ships with approved ECDIS systems to carry paper charts, as they now must under 1974 Safety of Life at Sea regulations, he believes "it's going to be a long, long time before we see their disappearance."—PETER TYSON

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Synthetic Spider Silk

Driven by the prospect of a shiny new fabric, French scientists of the eighteenth century packed barns with spiders in hopes of harvesting their gossamer webbing and spinning it into silky threads and sheets. But unlike their contented and docile thread-producing counterpart, the silkworm, which had been successfully colonized for centuries, the territorial spiders were less cooperative. When packed together in the numbers needed to produce large quantities of spider silk—thousands would have been required to make enough for a single dress—they drove away their fellow spinners or simply ate them.

Where eighteenth-century spider farming failed, twentieth-century genetic engineering is succeeding. Randolph Lewis, a molecular biologist at the University of Wyoming, and his colleagues have identified two genes responsible for making the material that comprises drag line, the strong yet highly elastic strand a spider uses to rappel down from a perch and to frame the outer edges and spokes of its web. By inserting the genes into a common type of bacteria, the team has created tiny biological factories that churn out proteins identical to those a spider spins into thread.

The interest in spider silk persists because of its unique properties. It is the strongest material known—five times stronger than steel. Yet it is 30 percent more flexible than nylon and can absorb 3 times the impact force without breaking than Kevlar, a synthetic material commonly used in bulletproof vests. “It is rare to find a material that has all these properties,” says Christopher Viney, a materials scientist at the University of



By removing silk-producing genes from the golden orb weaver spider (above) and placing them in common bacteria, researchers aim to mass-produce the shiny, silken thread—a material that is five times stronger than steel yet 30 percent more flexible than nylon.

Washington. “The spider optimized all three simultaneously.”

The key to the strength and flexibility of drag line is a unique system of interlocking molecules that Lewis calls a “Lego-Slinky” system. Using x-ray diffraction, spectroscopy, and nuclear magnetic resonance to study the proteins at molecular scales, he discovered that the silk thread is made up of long chains of molecules with either convex or concave snaps at their ends, allow-

ing two proteins to connect much as Lego building blocks do. Between these snapping ends is a spiral or spring shape. The connecting joints provide strength; the springs, elasticity, he says.

A material with such properties could find diverse uses. Thinner sutures made from spider silk thread might cause less bleeding and scarring in surgery. Thick braids of the silk could serve as cables in suspension bridges. Woven into nets, the material could restrain a fighter jet landing at high velocity on the deck of an aircraft carrier. In fact, says Lewis, “that’s exactly what a spider’s web is used for, to catch a fly moving at full speed.”

One early showcase for the material might be its use as artificial ligaments and tendons, says Lanny Johnson, an orthopedic surgeon at Michigan State University. Existing artificial ligaments made of synthetic polymers tend to lose shape after repeated flexing in the body, he says. Substitutes made with spider silk would

not only retain their shape better, but also remain more flexible. And because the proteins are a biological material, they are expected to integrate more effectively in the body.

To discover the secrets of spider silk, Lewis’s team studied the drag line of a large, venomless spider called the golden orb weaver, a yellow, brown, and gray streaked species indigenous to the southeastern United States. After determining that the drag line was composed of two proteins, which they called Spidron 1 and Spidron 2, the researchers isolated two genes in the spider’s thread-producing cells that matched the composition of the proteins. They then inserted the genes into a common *E. coli* bacterium, where the genes began directing the organism to produce the drag line.

To manufacture such material on a large scale, Lewis imagines large vats filled with a nutrient-rich solution that bacteria would feed on as they produce the silk proteins. He proposes harvesting the proteins by filtering the bacteria from the solution and freezing them, causing the organisms to break open and the strandlike proteins to spill out. After a chemical solution that attracts only silk proteins separates them from the broken shells and other proteins, the strands could be poured into another solution to strip away the chemical attractants. The silken strands could then be stored in water to prevent them from kinking up like a ball of spaghetti before they can be scooped out and fed into a conventional spinning machine.

Engineered Qualities

While such production techniques are still in the conceptual stages, Lewis is already exploring other potentially useful spider products. He has identified the genes involved in producing the thread that spiders apparently use to reinforce the edges of their webs. Lewis speculates that this material, which is stiffer than drag line, could be useful in bullet-proof vests because it is as impact resistant as Kevlar but a bit more flexible and thus more comfortable. Drag line would not be suitable for a vest, he adds, because while it would stop a bullet, it is so flexible that both the bullet and part of the vest would pass all the way through the body before coming to rest.

Viney notes that if a second version of synthetic spider thread isn't enough, the silk of 30,000 other spider species may offer yet more enticing qualities. "There's no reason to think this is the best one," he says.

Viney also offers an alternative strategy to hunting down the silk genes in all those spiders to find something better. Researchers could instead alter DNA segments of the silk genes in the golden orb weaver or any other spider and test the properties of the resulting proteins until they engineered the qualities they want. —DAVID GRAHAM

The Coolest Sound

In just a few years, refrigerators and air conditioners could be humming a different tune, keeping us cool by applying a recently discovered thermodynamic principle. Called thermoacoustic refrigeration, the process uses only environmentally friendly gases and sound.

The technique is a radical departure from conventional refrigerators and air conditioners, which capture cold from an evaporating liquid. This process starts

CFCs have been used in this process because they're cheap, nontoxic, and inflammable, and they turn from liquids to gases at temperatures and pressures ideal for food refrigeration. Unfortunately, when CFCs escape into the environment, they rise into the upper atmosphere, where they not only act as greenhouse gases but contribute to the breakdown of the earth's ozone layer.

While HFCs contain no chlorine and thus probably do not deplete the earth's ozone layer, the chemicals may still be

Physicist Steven Garrett is developing thermoacoustic refrigerators—systems that produce cold with sound waves—for the home and office by modifying these high-powered units originally designed to cool electronic components on board the space shuttle.



when a pump injects liquid—in most refrigerators a chlorofluorocarbon (CFC) or in newer models a hydrofluorocarbon (HFC)—into an evaporator, a coiled chamber kept at a near vacuum. When a fluid enters the vacuum, it evaporates. This phase change requires heat, and as tubes from the evaporator weave their way through a refrigerator's cooling unit, they suck the required heat from the surroundings, thus leaving the food-storage area cold.

To complete the cycle, the gas, now laden with heat, is pumped into a condenser, where it is subjected to high pressure. At this point, the phase transformation is reversed: the gas returns to a liquid, and the heat is released to the outside air through a network of tubes usually attached to the rear of the refrigerator. The fluid then returns to the evaporator, ready to start the cycle again.

potent greenhouse gases—possibly more potent than the CFCs that they replace. Michael Oppenheimer, a senior scientist for the Environmental Defense Fund, explains that the chemicals are so new that their behavior in the atmosphere is not well understood. Environmental groups thus consider HFCs only a stop-gap solution until a better alternative is found.

Thermoacoustic refrigeration just might be that alternative. The technique uses neither CFCs nor HFCs, exploiting instead an unusual relationship between temperature and sound. Glassblowers have known for centuries that a globe of hot glass at the end of a long metal rod frequently "sings" as it cools. But 10 years ago a group of physicists at Los Alamos National Laboratory—Gregory Swift, Thomas Hofler, John Wheatley, and Albert Migliori—discovered that the

process by which sound is produced from cooling could be reversed so that cooling could be produced from sound. The group since has been awarded several basic patents for thermoacoustic refrigeration, and several other teams are developing systems.

At the heart of every thermoacoustic cooling device is a loudspeaker mounted on the end of a metal tube—prototype units range from the size of an aspirin

Gases moving toward high pressure heat up as they are compressed, while those moving toward low pressure cool off as they expand. To capture the cold, most designs call for a simple heat exchanger, usually a strip of plastic rolled up like a jelly roll with an air space where the jelly should go. The coil is placed inside the tube—with its flat sides facing the flow of gases—about halfway between the high-pressure crest at the

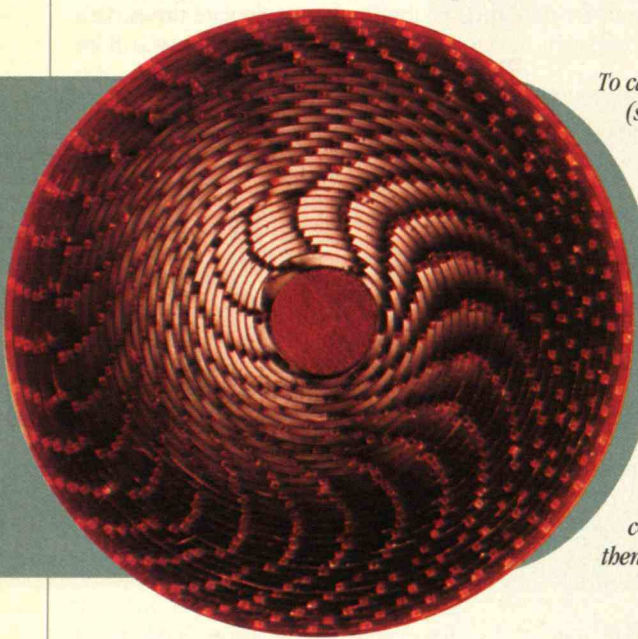
uses for thermoacoustic cooling, serving as a consultant to the Los Alamos group. Since then he has designed thermoacoustic units to provide vibration-free cooling for sensitive electronic components and sensors used in military satellites and by NASA—one flew aboard the space shuttle in 1992—and has recently set up his own lab to build commercial models. To demonstrate the effectiveness of a tabletop unit built for demonstration purposes, he flips a switch and a digital thermometer showing the temperature of the side of the coil facing away from the loudspeaker begins to change. After a few seconds, the temperature drops 5 degrees. After 10 minutes, it drops nearly 30.

Garrett explains that for spot cooling in uses such as electronic circuit boards, the cold can simply be conducted toward the desired object with a piece of metal called a heat pipe. For large-scale applications such as home refrigeration and air-conditioning, in which refrigeration would have to be delivered over greater distances, any environmentally safe heat-exchange fluid, even water, could be used to transfer coldness.

Thermoacoustic systems have two other potential advantages, Garrett maintains. The first is that thermoacoustic systems are quiet. Although the sounds inside can reach dangerous levels, the pressure vessel is so rigid that it does not vibrate at the same frequency as the gas inside. In fact, the only sound heard coming from Garrett's device is the slight hum of the pump moving the heat-exchange fluid.

The second advantage is control: "In an ordinary refrigerator, you have binary control: the system stays on and cools until it's too cold, then it shuts off until it's too warm," says Garrett. Conventional refrigerators therefore waste energy by overcooling. But a thermoacoustic device could avoid overcooling, he says, because it could be set to continuously maintain an exact temperature.

Such precision temperature control may also help make thermoacoustic devices more efficient than their conventional counterparts. "Unfortunately, it's kind of hard to make the comparison



To capture coldness, a plastic coil (shown here in cross section) is placed inside a thermoacoustic device's tube so that gases pass freely through the coil as they are pushed from one end of the unit to the other by a high-intensity sound wave. The gases warm up as they move toward the high-pressure portion of the wave, transferring heat to one side of the coil, and cool off as they oscillate back toward the low-pressure region, transferring cold to the other side. Coolness is then conducted to the desired location.

bottle to 40-feet long—filled with a mixture of stable inert gases such as helium and argon. When a tone of just the right frequency is played, a standing sound wave is created inside the tube so that the wave's crests form at each end and its trough lies in the middle.

Because sound is a pressure wave, the crests correspond to regions of highest pressure and the trough to that of lowest pressure. But while the pressure regions remain stationary, the gases in the tube are in constant motion as they are buffeted back and forth between the two high-pressure ends of the tube. When the volume is turned up to levels as high as 180 decibels—an intensity 100,000 times louder than a rock concert and one at which the pounding gases would destroy living tissue—the gases resonate forcefully back and forth.

speaker end of the tube and the low-pressure trough, so gases can travel through the air space in both directions.

That way, as gas molecules rush toward the high-pressure region and heat up, they blast through the coil, bumping into its walls and transferring heat to the plastic. An instant later, they reverse direction and dance through the coil toward the low-pressure trough, cooling down and transferring cold to the plastic walls. Each time the molecules oscillate, they move a tiny bit of heat in one direction, a tiny bit of cold in the other direction. With millions of molecules shifting back and forth, a significant temperature differential builds up at the two sides of the coil.

Steven Garrett, a physicist at the Naval Postgraduate School in Monterey, Calif., was one of the first to pursue practical

right now," says Garrett. The reason is that he has yet to build a refrigerator with efficiency in mind.

"My refrigerator is overpowered," admits Garrett. When he recently took an off-the-shelf refrigerator and replaced its compressor with a thermoacoustic system, the unit chilled the refrigerator's contents in half the time normally required. Instead of using the smallest amount of energy necessary to keep an ice-box cold, Garrett's unit spends a lot of energy for high-speed chilling. "That's not exactly what you want if you are going for the efficiency specs," he says.

However, rapid cooling may be ideal for coolers in water fountains and beverage vending machines. In fact, Garrett is helping an undisclosed company build a prototype of such a unit that he expects will be on the market in a few years.

Several other companies are quietly looking at some form of thermoacoustic-based cooling. In Detroit, the Ford Motor Co. is "doing exploratory laboratory research," says George Mozurkewich, an acoustic research scientist who is working on the project full time. In Oregon, Tektronix is exploring the use of thermoacoustics for cooling electronics in high-speed test equipment. In California, loudspeaker manufacturer JBL is pursuing research on the devices, seeking to capitalize on its experience with acoustics and possibly open up a new business area. And in Florida, Cool Sound Industries has bought the rights to the Los Alamos group's patents for using thermoacoustics in air-conditioning in hopes of building units for the home and office.

—SIMSON GARFINKEL

Using Thoughts to Control Computers

An enduring science-fiction fantasy has been the notion of linking the human brain directly to a computer. An individual would need only to think a command and the computer would respond.

That fantasy is no longer purely the stuff of fiction. A handful of scientists have begun devising interfaces that enable people with severe motor disabilities to use their thoughts to push a cursor around a computer screen, flip switches on and off, and even mentally type out words.

The novel brain-computer connections rely on electroencephalography (EEG), in which electrodes placed on the

Kids & their Environment



Projects for a Healthy Planet by Shar Levine & Allison Graft

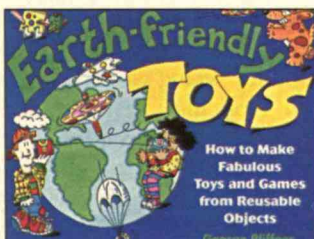
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scalp permit the monitoring of a person's brainwaves, the noisy cascade of electrical signals produced when trillions of synapses fire in the brain. Signal-processing electronics isolate particular patterns of activity from the ruckus, then amplify the signal and transmit it to a computer.

One team, led by Jonathan Wolpaw, a neurologist at the New York State Department of Health, is harnessing a brainwave signal known as the mu rhythm, a pattern of electrical activity produced by the part of the brain that controls sensory and motor functions. This area, known as the sensorimotor cortex, stretches from ear to ear over the top of the brain and emits brainwaves at a frequency of 8 to 12 Hertz.

Numerous experiments have shown that people can learn through trial and error to control the voltage, or strength, of the mu signal, when they are given feedback. Wolpaw devised a system that monitors the voltage of the mu signals the subjects emit and moves a cursor up if the signal is significantly higher than the median or down if it is lower.

Each subject sits in a chair, with electrodes placed directly above his or her sensorimotor cortex, and observes the cursor's movements in response to different thoughts. For example, Rory Duncan, a New York State Health Department employee who volunteered to test Wolpaw's interface, found that the cursor would go up if he thought about smiling, chewing gum, swallowing, or blinking his eyes. If he frowned or thought about squeezing a pen, the cursor moved down. After a while, he reached a point where he could think "up" or "down" and the cursor would move in that direction.

Wolpaw's group has tested the interface on more than 25 volunteers, including a number of disabled individuals, and found that 75 to 80 percent achieved consistent up-and-down control of the cursor within a few hours. They were able to push the cursor to a target on the computer screen within three seconds.

The team is now seeking to give users the ability to move the cursor left and

right as well. Toward that end, they have refined the interface to analyze the mu rhythm in greater detail, enabling subjects to use high and low voltages of signals at lower frequencies within the 8-to-12-Hertz range to move the cursor up and down, and high and low voltages of signals at the higher frequencies to move it left or right. In a first round of experiments, 80 percent of volunteers who were able to gain one-dimensional control of the cursor could also achieve such two-dimensional control.

Although Wolpaw is the first to admit that his brain-computer interface is still crude, he has begun taking steps to use it as an aid for people with severe motor disabilities. In collaboration with Todd Lefkowitz, an engineer who specializes in designing such products, he is adapting the system so that in addition to moving a cursor on a screen, the computer operates appliances, such as a radio, lamp, and television, when given mu-wave commands.

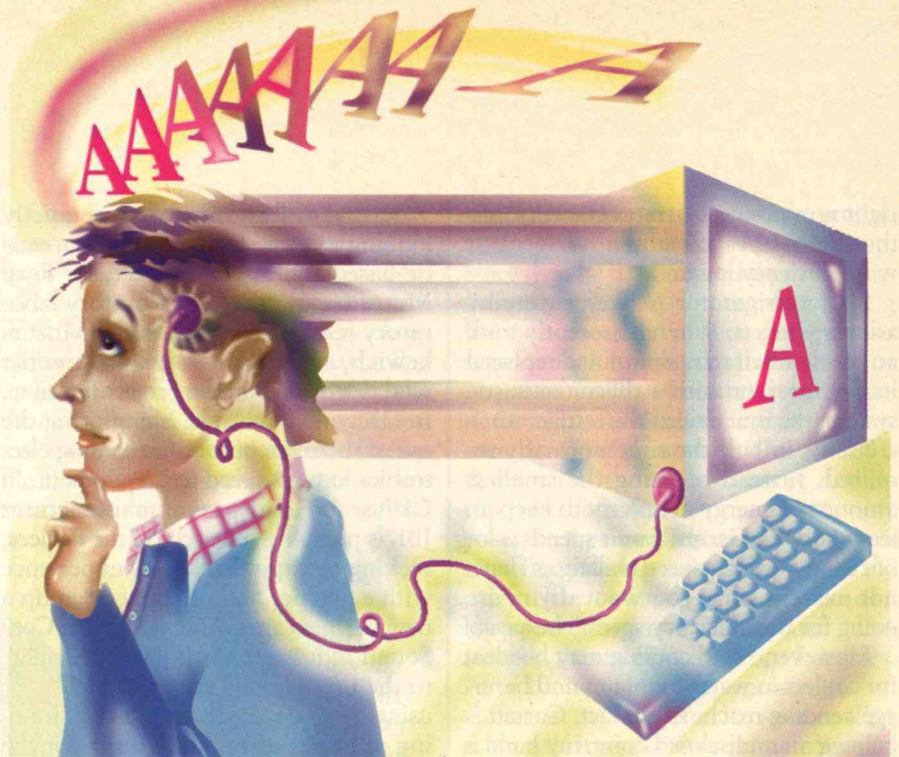
Emanuel Donchin, a professor of psychology at the University of Illinois, has taken the concept further by devising a method for typing words on a computer screen. Donchin's system takes advantage of a well-studied phenomenon known as the "oddball paradigm." Donchin and other cognitive psychologists have shown that when a person

views a sequence of items and mentally puts them into two categories—common and rare—he or she will generate a detectable change in brain-wave activity when the rare, or oddball, item appears. In essence, about 300 milliseconds after the rare item appears, the brain shouts "That's the one!"

Cutting Response Time

This blip in the brain's electrical activity, which can be recorded over many different parts of the scalp, is known as a P300 signal. Donchin reasoned that if a person wanted to spell a word and the letters of the alphabet were flashed on the computer screen one at a time, a P300 blip should occur each time the person saw the desired letter because only one out of 26 letters would fit the oddball characterization.

Of course, spelling out words in this manner, P300 signal by P300 signal, is painstakingly slow. To speed up the process, Donchin organized the letters of the alphabet and several one-word commands into a 6-by-6 matrix and flashed each column and row on the computer screen one at a time. Whenever a row or column containing the desired letter or command appeared, the subject's brain would emit a P300 signal. The computer could then identify the correct letter or



command simply by determining the one common to both the row and column singled out by a P300 signal. The matrix approach quickened the spelling process because any individual letter could be identified after, at most, 12 flashes of the rows and columns, rather than 36, one for each letter or command.

In one experiment, Donchin showed that people could use this matrix method to peck out the word "brain." A voice synthesizer then spoke the word. But the best subjects could do was "type" at a rate of 2.3 characters per minute.

Gurt Pfurtscheller, a biomedical engineer at the Technical University of Graz, Austria, is trying to develop a more direct approach. He hopes to harness the precise patterns of brain activity that occur when a person plans a specific action, such as moving a finger or toe.

Pfurtscheller has discovered that one or two seconds before a person deliberately moves a finger, a tiny disruption in brainwave activity occurs in the sensorimotor cortex. If the person intends to move his or her right index finger, for example, EEG activity in the brain's left hemisphere, which controls movements on the right side of the body, becomes measurably desynchronized. This disruption occurs even in people who are paralyzed.

As a first step, Pfurtscheller showed that this finger-planning activity could be used to move a cursor in two directions on the computer screen. After several hours of training the computer to recognize a subject's individual EEG patterns, the computer correctly identified 85 percent of the volunteer's planned finger movements.

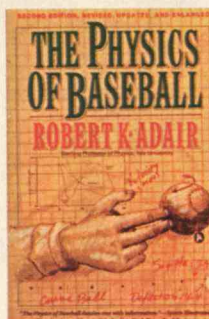
Pfurtscheller wants to adapt this approach to enable the computer to type out words or control other devices. For example, he plans to see if paraplegics can use the interface to operate an electronic device for emptying the bladder. If so, an individual could "choose" to urinate by mentally planning some type of movement such as of a finger or toe. The finger-planning activity would then serve as a thought command to switch on the device.—ROBERT WHITAKER

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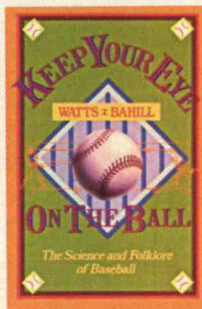
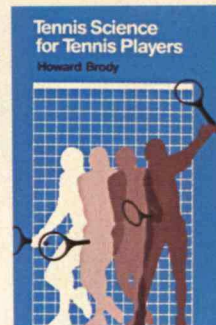
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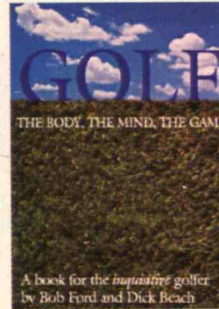
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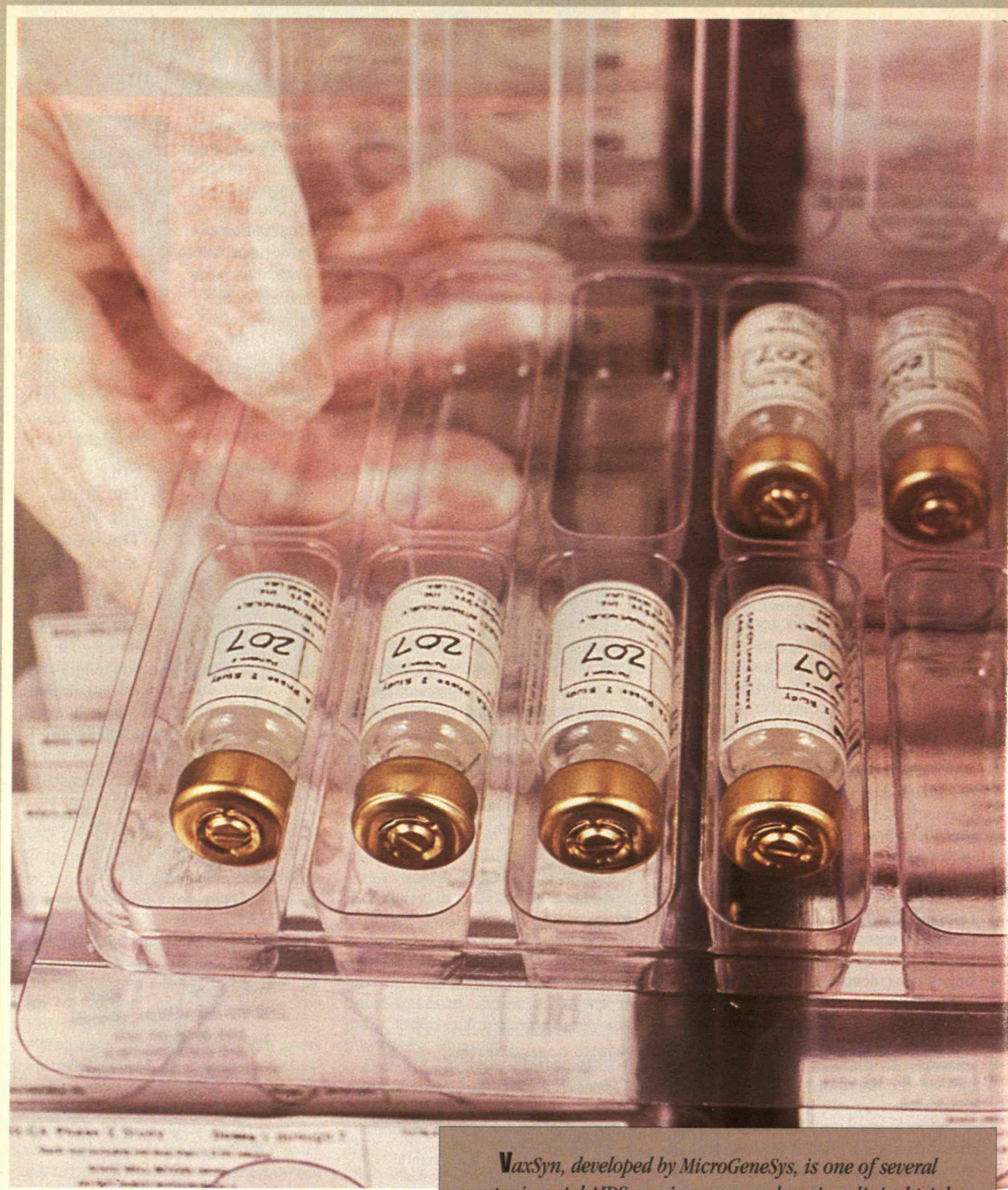
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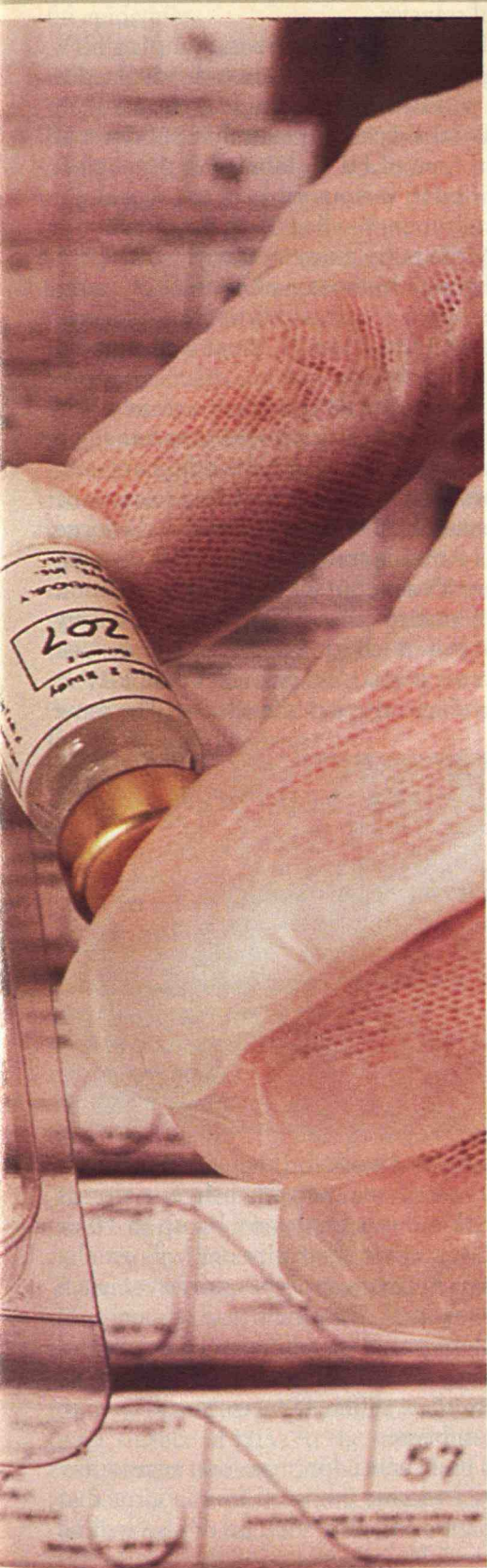
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VaxSyn, developed by MicroGeneSys, is one of several experimental AIDS vaccines now undergoing clinical trials.



Confronting the AIDS Vaccine Challenge

BY MAX ESSEX

Though the biomedical obstacles have been unprecedented, cooperative ventures between the public and private sectors could bring vaccines to market within three to five years.

IN the next decade, tens of millions of people around the world will become infected with the human immunodeficiency virus (HIV), the virus that causes AIDS. Once infected, each individual will have an average of five to ten years to live. Existing treatments cost tens or hundreds of thousands of dollars per person, yet they purchase just one or two more years of life. By contrast, a vaccine to prevent HIV infection would save not only lives but also money, costing \$100 or less to administer.

❧ Scientists have struggled for 10 years to develop an AIDS vaccine, without significant result. But today we know more about HIV than any other virus in history—far more than scientists knew about polio or hepatitis B when they created vaccines for these viruses—and we have made remarkable progress toward overcoming the biomedical obstacles involved. Still, to prevent a major expansion of the pandemic, including the spread of new strains to the United States, vaccine researchers will have to target the disease in areas where it is growing most rapidly.

More Than One Vaccine

HIV is a retrovirus that attacks and eventually destroys the immune system by causing a progressive loss of T helper lymphocytes. (A lymphocyte is a kind of immune cell that circulates in the blood; T helper lymphocytes, known as T4 cells, are required to activate most types of immune responses.) Nearly all adults who become infected with HIV remain healthy for four to six years before developing the first signs of disease. This period of dormancy may represent an initial immune response that temporarily restrains the virus. During this first phase of infection, fewer than one in a thousand T4 cells is infected; fewer than one in a thousand of these infected cells actually procreate at any particular time. Within eight to ten years of infection, however, the proportion of infected T4 cells begins to rise. Eventually, the virus's rate of replication exceeds the body's ability to replace damaged cells. Free virus spills over into the blood, and immune functions are lost.

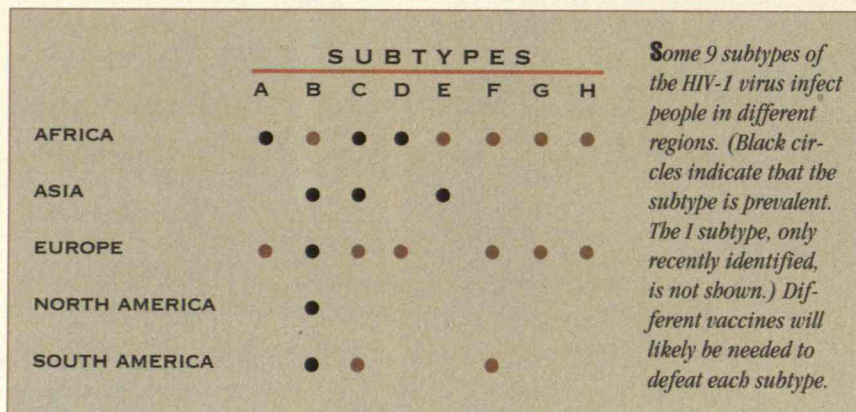
Throughout the course of infection, the genetic makeup of the virus is constantly changing. HIV mutates much faster than other viruses. Mutations may occur in the genes that dictate the kinds of proteins that form the virus's core or surface or in the regulatory genes that determine how rapidly the virus replicates. When mutations alter the virus's core or surface proteins, the biological properties of the virus may change. It may become more adept at infecting T4 cells or causing immune-cell pathology, making the virus more lethal. Other genetic changes may make it easier for the virus to evade the body's immune surveillance, even when it doesn't kill the immune cells themselves. New mutants may eventually emerge too fast for the immune system to respond. This may be one reason that the period of dormancy ultimately gives way to more severe infection.

The fact that HIV mutates so rapidly within its host means that more than one vaccine will almost certainly need to be developed. An infected person may harbor one version of the virus in the reproductive tract while a more mature version circulates in the blood. Thus the virus this individual might transmit through heterosexual intercourse is different from the virus he or she might transmit by sharing needles or through other blood-to-blood contact. A mature virus that can be maintained by blood-to-blood transmission may then lose some of the genetic characteristics needed for heterosexual transfer. As a result of this genetic variation, a vaccine targeting

blood-to-blood transmission will have to defeat a different version of the virus than a vaccine intended to prevent heterosexual transfer.

In addition, because the genetic makeup of HIV varies across regions as well as within individuals, different vaccines will be needed to defeat the virus in different regions of the world. At least nine subtypes of HIV-1 (the main type of HIV), labeled A through I, have been identified in various parts of the world. So far, only one subtype—B—has been found in the United States. Most people infected with subtype B were exposed through homosexual contact or intravenous drug use. As a result, subtype B, which has been in the West for 15 to 20 years, is not well adapted to heterosexual transmission.

Several other subtypes of HIV-1 predominate in different regions of sub-Saharan Africa. In western India, the dominant subtype is C; in Thailand, the dominant subtype is E. Subtypes found in Africa and Asia seem to be more easily transmissible between heterosexuals: more than 90 percent of Africans and Asians with HIV became infected by heterosexual contact. (HIV-2, the second major virus type found to cause AIDS, occurs primarily in West Africa; it is a much lower priority for vaccine development because it is far less prevalent than HIV-1, is transmitted less efficiently, and is less lethal. The same



vaccine will probably not work for both viruses.)

Although the genetic makeup of different strains within a given HIV subtype may vary by up to 10 or 15 percent, antibodies that neutralize one will usually neutralize another. Between subtypes, however, such cross-reactivity is minimal. The amino acid sequences of the core and envelope proteins of different HIV subtypes may vary as much as 20 or 30 percent. To boost the chances of success, then, different vaccines will have to be made for each subtype.

An individual's best chance for protection against any infection requires a vaccine prepared from a virus that exactly matches the virus to which he or she will be exposed—in particular, the piece of the virus that attaches to the host cell. This is why a new influenza vaccine is provided for each flu outbreak. But

MAX ESSEX is chair of the Harvard AIDS Institute and of the Department of Cancer Biology at the Harvard School of Public Health. He has made several discoveries crucial to the understanding of AIDS, including identifying the proteins on the surface of HIV closely linked to its lethal effects.

the HIV found in two different people can differ even more than flu viruses found in two distinct flu epidemics.

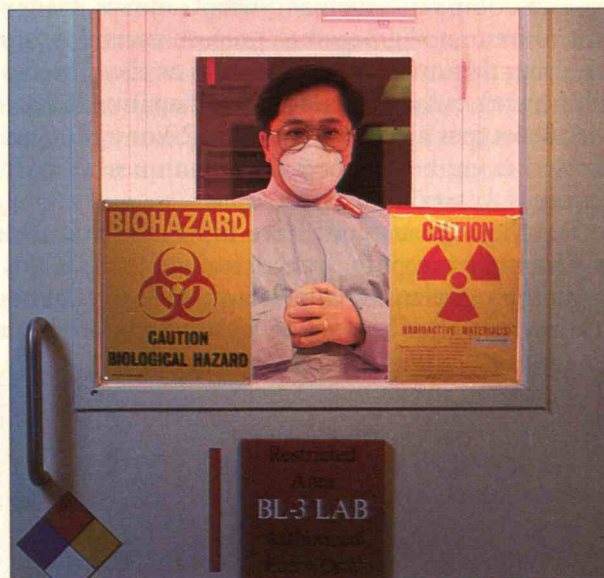
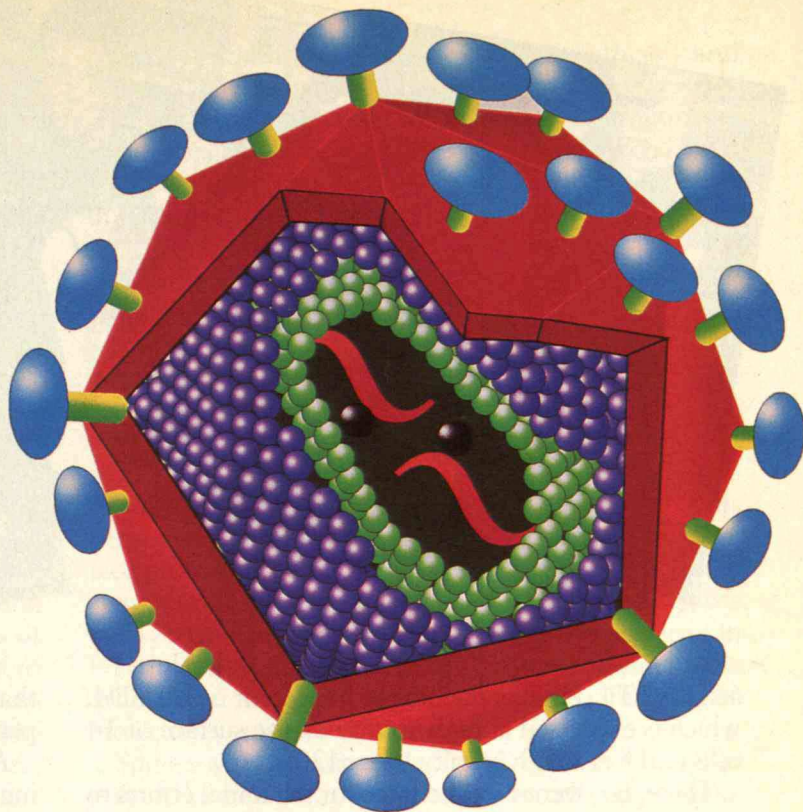
Take the hypothetical example of an American man who becomes infected with HIV through Factor VIII, a clotting factor used to treat his hemophilia. What variables should researchers consider in developing a vaccine to protect the man's wife? If a vaccine were prepared from a virus that perfectly matched that of the husband's in terms of viral subtype, transmission route, strain, and gene sequence, the wife might have a 90 percent chance of protection if she were exposed by the same route. But she would be exposed through semen, not blood—the route through which her husband was infected. This difference might reduce the protection rate to, say, 80 to 85 percent. If the vaccine preparation were made from a viral strain from the same region of the country where the Factor VIII donors reside, as opposed to the exact virus from the exact donor, the odds might decrease to 70 to 75 percent. If it derived from a virus in another part of the country, the protection rate might fall to 60 to 65 percent. If the vaccine were prepared using an African or Asian subtype, the odds of protection might be as low as 30 to 50 percent.

Creating an AIDS Vaccine

Like any other vaccine, an AIDS vaccine must stimulate the immune system to produce antibodies that will prevent the virus from bonding to the host cell. The first step in creating an AIDS vaccine, then, is to identify the tiny site on the virus's surface that latches on to the host cell. This is the surface protein, from which the vaccine will ultimately be made.

Like the proteins that cover the surfaces of other complex viruses, these proteins have sugars attached to them and so are called glycoproteins. The glycoproteins on the surface of HIV consist of two surface molecules that resemble a golf ball on a tee: gp120 is the ball, while gp41 is the tee. Together, they are known as gp160. Only a small, discrete region of the gp120 glycoprotein forms the bond with the target cell.

In 1985, Tun-Hou Lee, then a postdoctoral fellow at Harvard, and I identified the proteins on the outer surface of HIV. At the same time, other scientists were working on the other half of the puzzle: identifying the host cell attacked by HIV and discovering the receptor molecule on the surface of the cell, to which the virus bonds. In 1985, Steve McDougal of the Centers for Disease Control and Prevention showed that the virus preferentially



The spikes that punctuate the outer envelope of the HIV-1 virus are made of a sugar-covered protein, or glycoprotein, called gp120. These spikes help the virus infect its host cell—the immune system's T helper lymphocyte—by attaching to receptors on the lymphocyte's surface. Developing an AIDS vaccine has been difficult

because some of the sugars located along these spikes prevent the immune system from mounting an effective response to the virus. Harvard virologist Tun-Hou Lee (above) has used bioengineering to delete the interfering sugars from the gp120 molecule, paving the way for more effective vaccines.



Charlotte Read Kensil (fourth from left) and her colleagues at Cambridge Biotech are developing a new adjuvant, or immune stimulant, to boost the effectiveness of vaccines for AIDS as well as for other diseases. The adjuvant is made from a chemical found in the bark of the South American soapbark tree, one specimen of which Kensil grows in her office.



attacked T4 cells by attaching to a receptor called CD4, which is expressed at high density on the surface of T4 cells and has a high affinity for gp120.

These discoveries set the stage for the initial efforts to develop an AIDS vaccine. In the late 1980s, U.S. and European companies such as MicroGeneSys, Genentech, and ImmunoAg began to prepare vaccine prototypes, using the same basic techniques as those used to develop vaccines for diseases such as hepatitis B. Most of the prototypes are made from gp120 or gp160 and expressed using bioengineering techniques in mammalian cells, yeast cells, or insect cells.

So far, these prototypes have failed to produce a strong immune response. Indeed, in June the U.S. government shelved plans to launch large-scale tests of two AIDS vaccines after a panel of 35 scientists predicted

that they were likely to protect no more than 30 to 40 percent of potential vaccinees.

Although the prototype vaccines succeed in stimulating the production of antibodies, only a small proportion of these antibodies manage to block the segments of the gp120 molecule where attachment occurs. These are probably the only antibodies that will be able to defend against HIV infection. The rest of the antibodies are directed at blocking other parts of the gp120 molecule, and so provide no immune protection. What's more, while other sites on the gp120 molecule are able to stimulate the production of large numbers of antibodies, the strategically important sites are far less effective at inducing an immune response.

The problem of weak or diversionary antibodies is unique to HIV infection. With other viruses, such as

The incidence of AIDS is expected to rise dramatically in the next several years, with at least 90 percent of new infections occurring in the developing world. All the AIDS vaccines now in clinical trials are based on viruses taken from American and European patients and will not be effective in other regions such as Africa.

CUMULATIVE HIV INFECTIONS AS OF JANUARY 1

	MEN		WOMEN	
	1994	1996	1994	1996
NORTH AMERICA	963,000	1,087,000	160,000	181,000
WESTERN EUROPE	545,000	691,000	109,000	138,000
OCEANIA	24,000	28,000	3,000	3,000
LATIN AMERICA	1,002,000	1,182,000	250,000	295,000
SUB-SAHARAN AFRICA	6,411,000	7,881,000	7,052,000	8,670,000
CARIBBEAN	225,000	280,000	150,000	187,000
EASTERN EUROPE	25,000	30,000	3,000	3,000
SE MEDITERRANEAN	47,000	59,000	9,000	12,000
NORTHEAST ASIA	77,000	149,000	15,000	30,000
SOUTHEAST ASIA	1,968,000	6,236,000	984,000	3,118,000
TOTAL WORLD	11,287,000	17,623,000	8,737,000	12,637,000

those that cause flu or polio, the presence of antibodies that react with the virus indicates some level of immune protection. A vaccine that succeeds in mimicking the virus well enough to trick the immune system into producing a large number of antibodies will then protect subjects against infection. With HIV, however, both infection and vaccination produce high concentrations of largely useless antibodies. To make current vaccines effective, then, researchers must find ways to boost the immune response these vaccines produce, either by stimulating an increase in the overall production of antibodies or by eliminating the parts of the vaccine molecule that generate useless antibodies.

Innovative Approaches

Some scientists hope to improve the performance of AIDS vaccines by mixing in a better generic immune stimulant, or adjuvant, to enhance the effectiveness of the specific antigen—the virus or piece of virus used to provoke immune response. By boosting the overall production of antibodies, these adjuvants would presumably increase the number of protective antibodies, thereby augmenting the effectiveness of the vaccine.

Adjuvants are not particular to any given vaccine, but can be used with vaccines for diseases from tetanus to flu. The only adjuvant currently used in humans is aluminum hydroxide, which is relatively weak. Several researchers are now preparing to test new types of adjuvants for use with AIDS vaccines. One of the most promising is a stimulant developed by Charlotte Read Kensil of Cambridge Biotech. Known as QS21, it is a purified complex carbohydrate drawn from the bark of the South American soapbark tree, *Quillaja saponaria*. The new adjuvant has already been shown to work well with the feline leukemia vaccine and is now

ready for human trials. Once tested for efficacy and safety, it may be used with AIDS vaccines.

Better stimulants could improve the performance of almost any existing vaccine. For instance, the hepatitis B vaccine offers only about 85 percent protection against initial infection. Improved adjuvants might boost the proportion of cases covered to 95 percent.

Another important new approach under way is to redesign the antigen used in manufacturing the vaccine. Scientists are using genetic engineering techniques to delete the regions of the gp120 molecule that induce useless, interfering, or diversionary antibodies and to enhance the display of regions of the molecule that induce the production of neutralizing antibodies.

The production of weak or useless antibodies results from the density and distribution of sugars on the surface protein of HIV. The greater the degree of such glycosylation on a virus's surface, the weaker the host's ability to mount an immune response to a given virus. In HIV infection, glycosylation is a major problem: unlike other viral antigens used as vaccines, the gp120 molecule is at least half sugar.

Some sugars are attached to gp120 in such a way that they make it fit perfectly with the host cell receptor, like a lock and key. These sites help the virus survive by making it more infectious. A bioengineered vaccine molecule should preserve these sugar structures so that the antibodies created in response to the vaccine will also fit the virus perfectly. Other sugars, however, coat the entire molecule, creating a shield that makes it less effective at inducing any protective response at all—a process known as sugar masking. These sites should be deleted to enhance the body's immune response.

So far, vaccine researchers have grown bioengineered gp120 or gp160 vaccines either in mammalian cells, where the glycosylation process is most natural and

thus more likely to preserve attachment sites, or in insect or yeast cells, where fewer sugars are added and the effects of sugar masking are minimized. Neither solution has worked well: vaccines grown in mammalian cells do not solve the sugar masking problem, thus eliciting fewer antibodies, and vaccines made in insect or yeast cells do not generate antibodies that fit the virus well enough.

A more promising approach is to bioengineer a gp120 molecule that preserves the "good" sugars but eliminates the "bad" ones. The first step is to discover which sugars should be preserved and which deleted. Tun-Hou Lee, now a professor of virology at the Harvard

CHILDREN		TOTAL	
1994	1996	1994	1996
14,000	18,000	1,138,000	1,286,000
6,000	9,000	660,000	838,000
<1,000	<1,000	27,000	32,000
61,000	79,000	1,313,000	1,556,000
1,996,000	2,672,000	15,459,000	19,222,000
26,000	36,000	402,000	503,000
<1,000	<1,000	28,000	34,000
2,000	2,000	58,000	73,000
1,000	2,000	94,000	181,000
68,000	251,000	3,020,000	9,605,000
2,175,000	3,070,000	22,200,000	33,330,000

School of Public Health, recently mapped and analyzed all the sugar sites on gp120. He found that of 24 sites, about half maintain the same position even among different strains and subtypes of HIV. He reasoned that these sites must be essential to the virus's survival. And indeed, 6 of these 12 sites appear to help the virus infect human lymphocytes cultured in vitro. He concluded that these sites must be involved in maintaining the three-dimensional structure of the virus surface, while the other 6 must shield the molecule from the immune system.

Lee has now bioengineered new gp120 molecules to preserve the "desirable" sugar molecules and delete those that interfere with immune stimulation. A vaccine using the redesigned molecule is now ready for the first stage of clinical evaluation. If it works as expected, it promises to selectively generate protective antibodies, making it far more effective than other gp120 and gp160 prototype vaccines now being developed.

Although Lee invented this new approach to address the particular problems posed by HIV, a number of other illnesses, from malaria to schistosomiasis, have similarly resisted traditional methods of vaccine preparation. Most of these infections have not been considered important enough to warrant major research investments, since other methods of prevention or treatment are available. Lee's technique may lead to powerful new vaccines for such diseases.

Taken together, these two innovations—a more effective adjuvant and a redesigned antigen—promise to boost significantly the level of immune protection provided by any particular vaccine. But to maximize protection against HIV, a variety of vaccines will still be needed, based on the specific epidemiological variables—subtype, stage of infection, and route of transmission—that characterize HIV infection within different target populations.

Testing in the Right Places

Today, more than a dozen prototype AIDS vaccines have been tested for safety; three or four are ready for large-scale human trials to determine efficacy. So far, however, all of the current prototypes address the major epidemiological variables in the same way: most were prepared from viruses taken from American or European patients with advanced AIDS who contracted the disease through drug use or homosexual transmission. At the time these samples were drawn, in the 1980s, researchers simply did not realize the degree or importance of genetic variation in HIV. As a result, the vaccines developed from these sample viruses are best suited to protect against subtype B, and against blood-borne

All the vaccines now in clinical trials are better adapted to boosting the immune response of people already infected than to preventing infection in the first place.

rather than heterosexually transmitted infections. (Male homosexual intercourse is sometimes considered blood-borne rather than sexual transmission because the virus is likely to enter the bloodstream directly, as a result of tears and bleeding in the rectum.) Moreover, because they target genotypes found in later rather than earlier stages of infection, all the vaccine antigens now being developed are better adapted to therapeutic uses—boosting the immune response of people who are already infected—than to preventing infection in the first place.

So far, companies have proven unwilling to invest in the development or testing of preventive vaccines for heterosexuals in developing countries, despite the fact that such individuals will account for 90 percent of the 50 million new infections anticipated in the coming decade. Western man-

ufacturers see little chance that the investment in a vaccine for use in developing countries would pay off. Because the process of producing an AIDS vaccine is so complex, the ultimate product is likely to cost something like \$100 per dose, well beyond the price range of most people in developing nations.

The corporations sponsoring vaccine research also favor the development of therapeutic vaccines over the development of preventive vaccines. Even though it is more difficult to make a therapeutic vaccine—it's hard to generate an immune response strong enough to control or reverse an infection that is already established—therapeutic vaccines are likely to be more profitable because frequent doses of large amounts of vaccine protein will be needed to maintain immune protection. A preventive vaccine would need to be administered only once or a few times.

Research on a therapeutic vaccine, moreover, is not likely to bring us much closer to a preventive vaccine. It is impossible to tell whether a vaccine might boost immune responses in a healthy person by testing it on a person whose immune system is already compromised. For example, the fact that an experimental vaccine fails to stimulate antibody production in an infected person might simply mean that the patient's immune system is damaged. The vaccine would need to be tested all over again to determine whether it would work better in a person whose immune system was intact.

It is essential that researchers redouble their efforts to develop preventive vaccines, and that these new prototypes be based on HIV subtypes found in Africa and Asia. Because the rates of new infections in many African and Asian countries are so much higher than in North America and Europe, prototypes targeting these subtypes can be tested much more quickly than prototypes targeting subtype B. When rates of infection are



Uganda's AIDS-control program travels to remote communities (left); Kenyan researchers monitor the AIDS epidemic (below). To ensure that AIDS vaccines targeting the subtypes commonly found in the developing world are created and widely distributed, wealthy nations and international agencies such as the World Health Organization will have to step in with funding and support.



high, far fewer participants are needed to show positive results, and the process takes far less time. For example, if the rate of new infections is 10 percent, as it is for some populations in Thailand, Uganda, and Rwanda, we could demonstrate with statistical confidence that a vaccine candidate protected 60 percent of the vaccinees if it reduced the rate of new infections from 100 to 40 in a vaccinated population of 1,000. If the rate of new infections is 0.1 percent, as it may be in some U.S. populations, obtaining the same information in the same time period would require 100,000 vaccinees.

By testing a smaller number of participants in countries like those mentioned above, researchers could save money, time, and ultimately lives. Several small trials could be conducted for the cost of conducting a single large-scale trial in the West, allowing researchers to gain information about the effectiveness of different viral strains, adjuvants, molecular configurations, doses, and methods of administration. Testing prototype vaccines in countries where HIV is spreading most rapidly could significantly reduce the amount of time it will take us to arrive at a workable HIV vaccine—time in which countless new cases of HIV infection will otherwise occur.

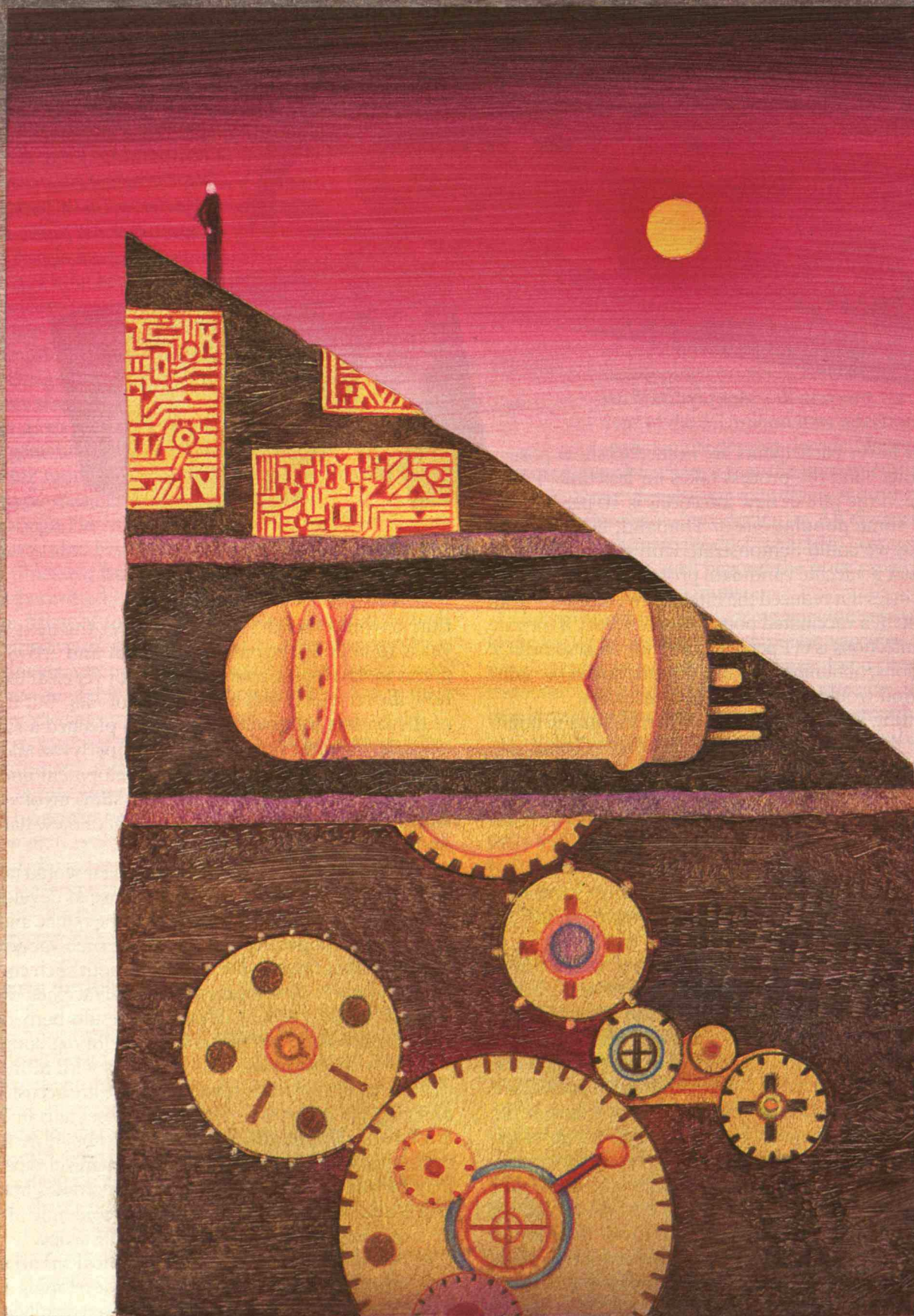
An international agency such as the World Health Organization, or the wealthy nations themselves, must step forward to assume the costs of developing and distributing AIDS vaccines for preventive use in poor countries. WHO has already taken similar steps to ensure the distribution of vaccines for certain childhood diseases, such as the DPT (diphtheria-pertussis-typhoid) vaccine. The difference is that these vaccines are no longer expensive to produce, so the overall cost of subsidizing production and distribution is much lower than for an AIDS vaccine. In the case of hepatitis B, which requires a more expensive vaccine, WHO has proceeded more cautiously. But this is no time for caution.

Early in 1994, the Japanese government announced

that it would spend \$3–4 billion over the next seven years to support population control and AIDS programs in developing countries. It is not yet clear exactly how the recipients will allocate this money. But if each of the leading industrialized nations pledged a similar amount, the total sum (allocated properly) would certainly be enough to support the development and distribution of this crucial vaccine. The sums involved are large, but they represent only a fraction of these nations' overall foreign aid budgets.

Reasonable people differ on how long it would take to develop effective AIDS vaccines for use in developing countries. My own estimate is that, if the public and private sectors cooperate, they can bring such vaccines to market within three to five years. Without such cooperation, however, development of these vaccines will be delayed indefinitely, with devastating results both locally and abroad. Subtypes present in developing countries will likely spread to the West, perhaps with more efficient heterosexual transmission than we are accustomed to seeing for subtype B. Among heterosexuals in Thailand, for example, subtype E seems to be more easily transmitted and to move much faster than subtype B. It may be just a matter of time before it crosses borders and oceans to trigger a more serious epidemic among heterosexuals in the United States and Europe.


If we are not motivated by the ethical mandate of protecting millions of people at risk in developing countries, perhaps the threat of newer and even deadlier HIV epidemics at home will goad us to action. ■



Distributing Our Technological Inheritance

BY GAR ALPEROVITZ

A VARIETY OF EXPERIMENTS
ARE BUILDING ON THE NOTION THAT
ALL CITIZENS SHOULD SHARE IN
THE BENEFITS OF A COMMON AND
PRODIGIOUS LEGACY.

MANY times a day,” wrote Albert Einstein, “I realize how much my outer and inner life is built upon the labors of my fellow-men, both living and dead.” The genius of an earlier era saw clearly how contemporary knowledge and technological advance depend to an extraordinary degree on the efforts of many contributors, not to mention a continuing cultural investment in science and numerous other areas of human endeavor.  In fact, very little of what we as a society produce today can be said to derive from the work, risk, and imagination of citizens now living. Achievements from earlier eras, including fundamental ideas such as literacy, movable type, simple arithmetic, and algebra, have become so integrated into our daily lives that we take them for granted. What we accomplish stands atop a Gibraltar of technological inheritance. Seemingly contem-

ILLUSTRATIONS: JAMES ENDICOTT



porary transformations inevitably build on knowledge accumulated over generations.

For example, Richard DuBoff, an economic historian at Bryn Mawr College, observes that “synthesizing organic chemicals...could not have been done without an understanding of chemical transformations and the arrangement of atoms in a molecule. After 1880, this led to the production of coal tar and its derivatives for pharmaceuticals, dyestuffs, explosives, solvents, fuels, and fertilizers, and later petrochemicals....By the early 1900s the new chemicals were already becoming an essential input for metalurgy, petroleum, textiles, and paper.”

Present-day entrepreneurs such as Bill Gates, one of the world's richest individuals with a personal fortune estimated at \$8 billion and hailed as a technological genius for inventing software for the personal computer, should therefore be seen as beneficiaries of this long and fruitful history as well as of significant public investment.

The personal computer itself—without which Gates's software would not be possible—owes its development to sustained federal funding during World War II and the Cold War. “Most of [the] ‘great ideas in computer design’ were first explored with considerable government support,” according to historian Kenneth Flamm in a Brookings Institution study. Now a specialist in technology policy in the Department of Defense, Flamm estimates that 18 of the 25 most significant advances in computer technology between 1950 and 1962 were funded by the federal government, and that in most of these cases the government was the first buyer of new technology. For example, Remington Rand Corp. delivered UNIVAC, the original full-fledged U.S. computer, under contract to the U.S. Census Bureau in 1951.

The government's shouldering of huge development costs and risks paved the way for the growth of Digital Equipment Corp., which created its powerful PDP line of 1960s computers. In turn, Gates's colleague (and now fellow billionaire) Paul Allen created a simulated PDP-10 chip that allowed Gates to apply the programming abilities of a mainframe to a small, homemade computer. Gates used this power to make his most important technical contribution: rewriting the BASIC language, itself funded by the National Science Foundation, to run Altair, the first consumer-scaled computer. And indeed, Micro Instrumentation and Telemetry Systems, Altair's developer, could never have placed a microcomputer

of any variety on the market without the long preceding period of technological incubation.

Thousands of links in a chain of development—our shared inheritance—were in fact required before Bill Gates could add his contribution. But if this is so, why do we not reflect more fully on why Gates, or any other wealthy entrepreneur, should personally benefit to such a degree? If we admit that what any one person, group, generation, or even nation contributes in one moment of time is minuscule compared with all that the past bequeaths like a gift from a rich uncle, we are forced to question the basic principles by which we distribute our technological inheritance.

Plainly put, the way we allocate the benefits of present and past economic activity that stem from this technological inheritance is irrational and unjust. The top one-fifth of U.S. society receives approximately 50 percent of all income, including interest, rent, and dividends. The bottom one-fifth—roughly 52 million people—makes do on less than 4 percent of such income. Even more striking, a mere 1 percent of U.S. families at the top reap as much income as the entire bottom 40 percent. The top 1 percent also holds more of the nation's wealth in the form of stocks, bonds, and real estate than the bottom 90 percent—some 232 million people.

Some of this disparity stems from the fact that anyone who happens to be lucky enough to work in an industry experiencing technological advance may be highly rewarded simply by virtue of being in the right place at the right time—as were many ordinary workers during Silicon Valley's boom years. Yet employees in industries suffering from severe international competition, such as auto manufacturing, lost their jobs during the same period despite their hard work, risk taking, and personal merit. Such serendipitous disparity is even more striking among residents of rich versus poor countries: machine operators may be paid \$17.85 an hour in the United States but just \$2.70 to run the same equipment in Mexico, for example.

Our technological legacy is also distributed unequally because it is largely bestowed on the heirs of the privileged few. Though economists differ on precisely how much current income derives from inherited wealth, Harvard economist Lawrence Summers, now undersecretary of the treasury, has estimated, along with Laurence Kotlikoff of Boston University, that at least 46 percent of today's accumulated wealth is directly inherited—that is, goes to recipients because they were lucky enough to have been born into the right family rather than because of their own hard work or risk.

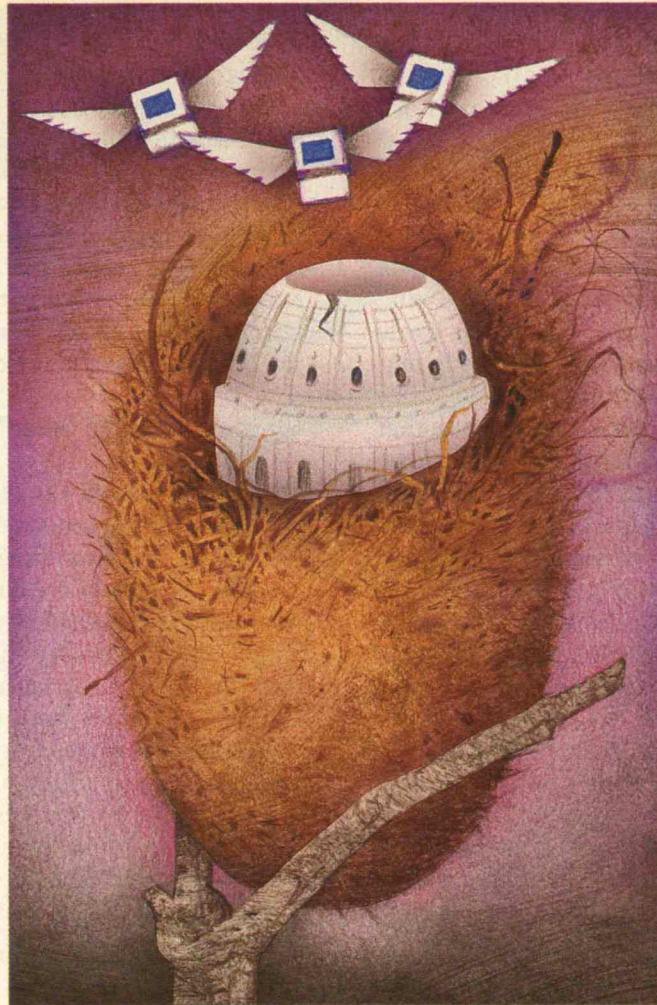
This system is largely self-perpetuating: people with access to money and the power that comes

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with it are in a position to obtain more. The fortunes amassed by the industrialists of one era beget generations of family wealth. Besides inheriting this wealth, children of the rich are able to go to the best schools and turn connections into high-paying jobs and further lucrative investments. A recent estimate by economist Edward N. Wolff of New York University suggests that over 70 percent of the growth in personal wealth since 1962 has resulted from initial holdings that have simply appreciated in value.

Democracy and Economic Power

Given that all current monetary gains depend so significantly on a free gift from the past, how could we allocate those gains more fairly? For one thing, inheritance taxes could be substantially increased. Andrew Carnegie, founder of Carnegie Steel and one of the nineteenth century's greatest "captains of industry," believed that accumulated resources should go to the community as a whole rather than largely to the progeny of rich individuals. "Men who continue hoarding great sums all their lives, the proper use of which for public ends would work good to the community, should be made to feel that the community...cannot...be deprived of its proper share," Carnegie wrote in 1889. "By taxing estates heavily at death the state marks its condemnation of," or at least its imposition of time limits on, such selfishness. The contradiction between democracy and inheritance so bothered James B. Conant, former president



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of Harvard University, that he proposed we confiscate all property "once a generation" to "prevent the growth of a caste system."

James Meade, a Nobel Prize-winning economist now retired from Cambridge University, has suggested a system in which "every gift or legacy received by any one individual would be recorded in a register against his name for tax purposes. He would then be taxed... according to the size of the total amount which he had received over the whole of his life by way of gift or inheritance."

Yet we clearly confront a far deeper problem than inheritance of individual wealth and property. If we agree that today's technological progress is akin to a pebble resting on a mountain of previous achievements, then a substantial portion of society's current income should go as a matter of equal right to each individual, apart from the amount he or she earns from current work or risk, or to the entire community.

Public ownership of patents and copyrights after an individual's or company's control has expired might be one mechanism for accomplishing this. Rather than simply allowing whoever is best situated to take advantage of such knowledge for free, the national treasury would accrue licensing revenues on the principle that the invention resulted largely from general knowledge created over time by the whole society. The government could distribute such revenues equally among all citi-



zens or use the funds to support public institutions such as schools. Education would be an especially appropriate outlet given that businesses rely on schools to produce skilled citizens who have absorbed society's accumulated prowess.

Louis Kelso, a prominent corporate lawyer based in San Francisco who died fairly recently, proposed another tack. Aware from experience that the rich commonly gain title to new wealth by borrowing against what they already have, he sought some mechanism for the nonrich to do the same. He reasoned that a government trust fund could function as a guarantee, as do the portfolios of old wealth that some individuals use as collateral, to allow those without capital to obtain loans for purchasing and holding stocks. The stock would be held in escrow until the government-guaranteed loans were paid off. Because he also proposed that corporations pay out all profits to stockholders, Kelso estimated that seven years of dividends would be needed to pay back the loans plus interest, at which time those previously without capital would become full stockholders and receive, as a second income, all further dividends.

In this conservative lawyer's view, both economic well-being and democracy were at stake: "Any society seriously caring about freedom must structure its economic institutions so as to widely diffuse economic power while keeping it in the hands of individual citizens," Kelso held. "Nor can freedom in an industrial democracy be long maintained unless the economic well-being of the majority is reasonably secure. Never in history has universal suffrage been built on a sound economic foundation; it is this defect, not the ordinary man's inability to cope with freedom, that accounts for the notorious fragility of democratic institutions."

Harvard law professor Roberto Mangabeira Unger proposes still another possibility: that the government establish a "rotating capital fund" to democratize the use of society's wealth. "Capital takers"—entrepreneurs and other business investors—would pay a substantial interest charge and thus establish a large flow of income back to the public, to be distributed to individuals or invested in public needs. No one would have a permanent right to the use of capital: it would be on loan from the community. Each capital fund would distribute its resources through auctions, under which capital takers could buy one another's resources, or through a rotation system, in which the fund would take a more direct role in planning the allocation of capital. Clear limits would be set on the amount any individual or group could accumulate before returning the funds to the community or transferring them to other uses.

Of course, until recently socialism—the notion that the state should own all property on behalf of the

people—was the most common mechanism for protecting and distributing society's technological inheritance. But aside from the practical difficulties of creating a well-functioning economy based on such ownership, a central problem with this idea is that power attaches itself to wealth. As with private corporate property under capitalism, but far more intensely, concentration of wealth usually leads to excessive state power. Still, more limited forms of public control of capital may enable citizens to reap the benefits of technological advance.

Ensuring a "Social Wage"

Though the efforts are clearly *very* limited, some countries and communities are beginning to experiment with mechanisms for ensuring a more sound foundation for democracy by awarding citizens a "social wage" simply because they are part of the community. In 1976, for instance, voters established the Alaska Permanent Fund Corp., which calls itself "a public trust for investing in Alaska's future." Created from leasing fees paid by oil companies and other mining companies drilling on state-owned lands, the fund is designed to enable all Alaskans to reap "permanent benefits from its great oil bonanza." The trust, which collected 18 percent of the state's oil revenues between 1977 and 1993, operates independently of the normal state budget and invests in real estate, stocks, and similar vehicles that add further value to the pool.

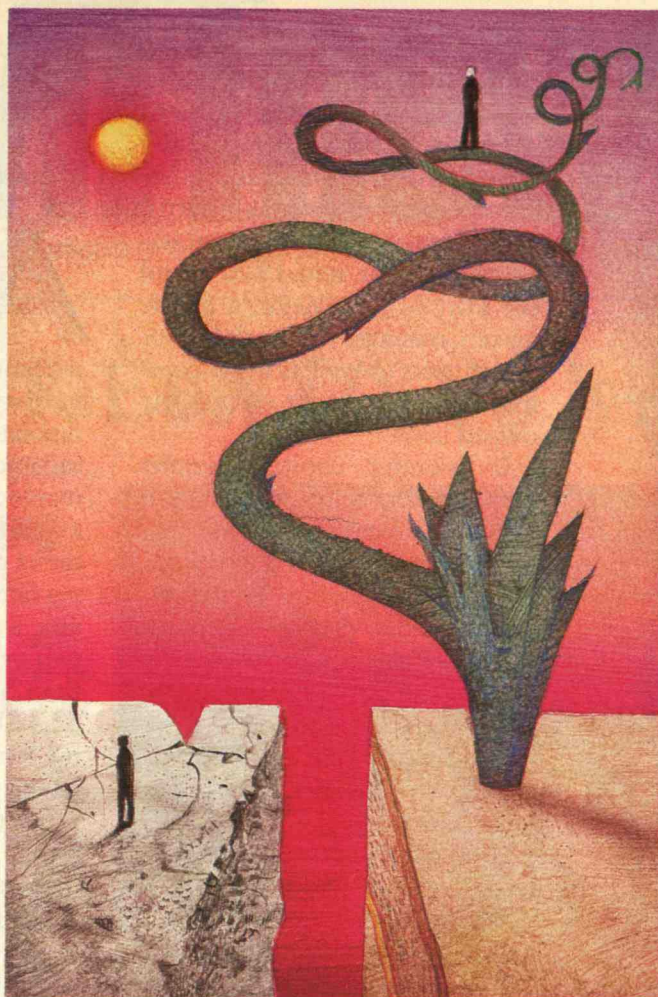
The Alaska Permanent Fund has awarded some 41 percent of its earnings—over \$4.1 billion—directly to Alaskan citizens since 1977. In 1992, half a million residents received \$916 each from a principal of over \$12.3 billion, and the fund is expected to pay out more than \$16 billion in dividends by 2010. A family of four that invests these dividends until the year 2005 at an 8 percent rate of return will accumulate an asset worth \$67,752 in today's dollars.

Other states are finding additional ways to ensure public control of capital. North Dakota's 75-year-old state bank and Wisconsin's state-owned insurance company earn money for the public treasury, for example. And many states are experimenting with entrepreneurial programs. Connecticut has established a program that provides start-up capital and grants to promising small businesses developing new products; the state receives royalty income in return. Minnesota and Wisconsin also supply venture capital to private investors. Public-employee pension funds have similarly become powerful economic actors while gaining income for state workers: Retirement Systems of Alabama, for example, earns an average of over 9 percent on its investments, which include

local lumber, chemical, steel, and aircraft industries. This growing trend toward "entrepreneurial government" is demonstrating practical mechanisms for using fundamentally different principles to distribute the benefits of accumulated capital and our technological inheritance.

Even more interesting, and perhaps more important, are activities at the local level: cities that have in some way communitized capital ownership. David Osborne and Ted Gaebler, in *Reinventing Government*, have cataloged community-owned cable systems, hotels, fertilizer-manufacturing companies, towing services, real-estate development efforts, and professional sports teams from the Green Bay Packers in the National Football League to the Toledo Mud Hens in minor-league baseball. Supplementing this list are thousands of efficiently run city-owned electric utilities.

Another strategy for broadly distributing technological gains taps into increases in the value of land. Ebenezer Howard, Britain's turn-of-the-century father of modern city planning, proposed that planned communities along the lines of his famous Garden City vision buy up cheap agricultural land, which would be "vested in trustees, who hold it in trust for the whole community, so that the entire increment of value gradually created becomes the property of the municipality." Like the private developer who builds a shopping center, the community would obtain its returns by renting property at rates appropriate to the



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AS AFFORDABLE
HOUSING.

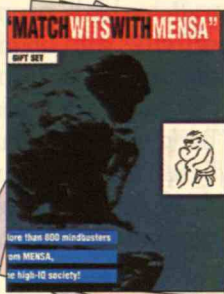


value of the site and its supporting infrastructure. This mechanism would allow social control over local enterprises, since citizens would decide who to lease land to and on what terms. According to Peter Hall, professor of city and regional planning at the University of California at Berkeley, Howard believed "he had found a third socio-economic system superior both to pure capitalism and to socialism. Local communal ownership of land would supply abundant resources for generous public services, creating a local welfare state, directly responsible to the citizenry."

Dozens of communities—urban, small-town, and rural alike—have established land trusts based on this general principle, often using revenues to help build affordable housing. According to a recent study by the Urban Land Institute, 84 projects between 1982 and 1985 combined public ownership of land with economic development. In 1984, for example, the city of Santa Clara paid \$88.5 million for 200 acres owned by the Marriott Corp., which had operated a "Great America" theme park on the land. Santa Clara sold the amusement park—but not the land—to Kings Entertainment Corp., which agreed to pay \$5.3 million a year for the next 50 years for the lease, enough to cover the initial costs of the acreage within 15 years. Santa Clara thus took part of its future out of the hands of developers and put it into the hands of the community while making

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money for public use. Similarly, to maximize revenue, the Washington (D.C.) Metropolitan Area Transit Authority has promoted development of office and other commercial buildings on Metro-owned real estate at seven rail stations since the mid-1970s. And the Port of San Diego, a public agency, manages the area's harbor and airport as well as other commercial development on publicly owned land.

If owning capital permits greater access to the flow of technology's benefits, then another obvious possibility is democratizing the ownership of capital directly—the goal of worker-owned enterprises. As Yale political scientist Robert Dahl puts it, “By dispersing income from ownership more broadly and by bringing executive salaries and bonuses into line [typical of the better worker-owned firms], a system of self-governing enterprises would produce a more equitable distribution of wealth and income.”

Experimentation in this direction is also far more widespread than commonly recognized. The number of U.S. firms with some form of companywide stock ownership approaches 10,000 and encompasses over 10 million people—more than the membership in private-sector labor unions. United Airlines is the latest example. Some of these companies engage all employees in decision making while others retain a traditional management structure. They range from tiny shops to large manufacturing enterprises, among them plywood firms in the Pacific Northwest, Avis Rent-a-Car, and Weirton Steel.

In a similar vein, 4,000 consumer-goods co-ops, 13,000 credit unions, nearly 100 cooperative banks, more than 100 cooperative insurance companies, 1,200 rural cooperative utilities, nearly 5,000 housing co-

ops, and 115 telecommunication and cable co-ops enable members to share in income.

Toward a New Economic System

At the federal level, both Republicans and Democrats support an expensive measure that acknowledges the inequity of the U.S. economy's traditional mechanisms for allocating income. The system of earned-income tax credits, recently expanded by Congress, provides direct payments—cash—to working families who do not earn a livable wage. By 1996 families with two or more children making less than \$27,000 will receive up to \$3,370, with smaller families earning lesser amounts also receiving payments. Overall the program is projected to distribute \$24.7 billion to 15 million families and 4.5 million childless workers by 1997. Raising these payments, unlike those distributed under welfare and other “charitable” programs, was one of the least contentious features of last year's budget bill.

Like the other proposals and experiments now on the table or under way, this tax credit does not squarely confront the irrationality of our present economic system or try to determine exactly what portion of current production stems from the free legacy our society receives from the work and ideas of previous generations versus the small amount individuals add today. Yet each initiative begins to challenge the once-hallowed notion that ownership of property or current labor should confer primary title to our technological inheritance. Such experiments could eventually challenge the principles at the heart of both traditional capitalism and traditional socialism, perhaps one day spawning a new economic system based on the notion of common inheritance. ■

MITnews

FROM THE ASSOCIATION OF ALUMNI AND ALUMNAE OF MIT OCTOBER 1994

REUNIONS '94

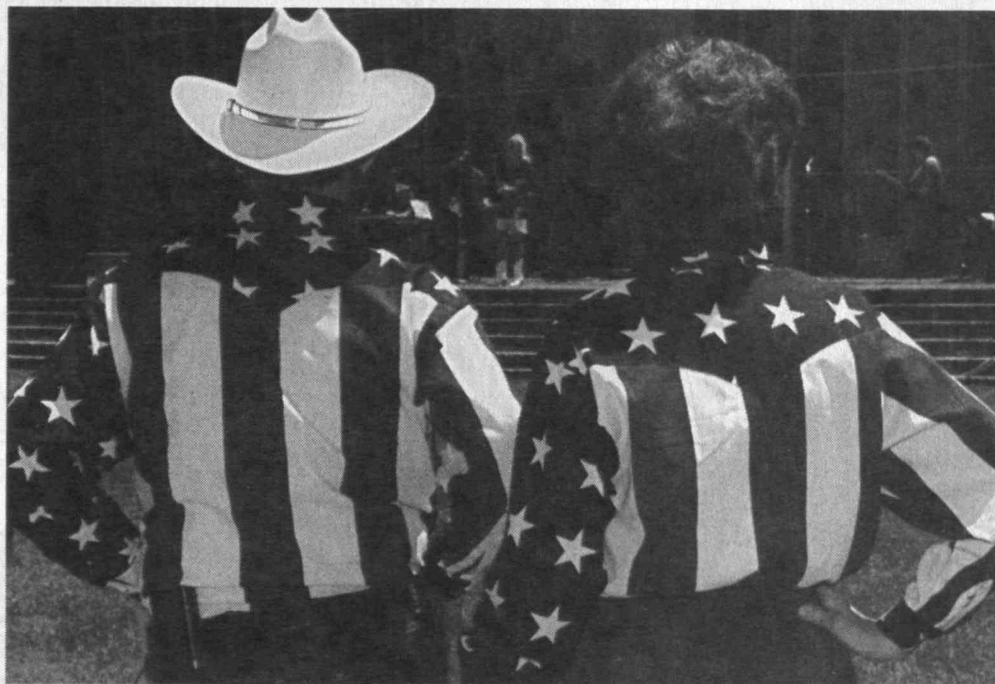
Back to the Future

BY DIANA BEN-AARON, '85

A selection of the seemingly infinite number of excuses for not showing up for a reunion:

No one else will be there. Everyone else will be selling insurance. Everyone else will have made vice-president. Holden Caulfield was right: All they'll talk about is "how many miles they get to a gallon in their goddam cars." No one will recognize me. All my ex-crushes will be married with children. Everyone else will be in better shape. If I go back, I'll start having nightmares about 18.01 finals again. They've changed the locks on all my favorite places, if not demolished them entirely.

To put most of these fears in perspective, one must remember: MIT is not high school. For one thing, the status barometer in the 02139 zip code is much more forgiving. Of course, it's bound to be easier to come back if you're at a local maximum of achievement (and a local minimum of waist size), but classmates understand how transient those highs and lows can be. We've all seen each other one impossible problem set away from despair, one good test grade away from elation.



THE TEXAS BARBEQUE WAS A "GETTIN' DOWN" SORT OF EVENT, WHAT WITH A PERFORMANCE BY COUNTRY-MUSIC-AWARD-WINNING SINGER ROBIN RIGHT (WIFE OF FRED SILVERSTEIN, '64), WHO FOLLOWED THE TEXAS TWO-STEP LESSONS WITH HERB NORTON, '64, AND HIS WIFE, SUSAN. EVEN WHEN HERB CONDUCTED CLASS ON THE KRESGE OVAL, THERE WAS NO PROBLEM SPOTTING THE INSTRUCTORS IN THEIR ALL-AMERICAN SHIRTS.



Another change from high school is that all the reunion classes converge on Technology Day in a sobering spectacle: the 15 ages of man, linked only by a common ordeal in freshman calculus and physics. Anyone who feels jaded at age 30 or 45 or 70 can regain some perspective by



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Define "Thin" Alumni/ae may well be puzzled when they read editor Steven Marcus's "First Line" (page 3), where he talks about the fact that Technology Review is, in trade terms, a "small book," even skinny. After all, you hold in your hands a publication that includes a 72-page **MITnews**, the largest alumni/ae section in the magazine's history. In fact, the Review is two magazines: a national magazine of technology and policy that circulates to some 55,000 non-MIT readers, plus an alumni/ae publication inserted in copies that go to donors to the MIT Alumni/ae Fund. A unique institution, a unique magazine. It figures. —SUSAN LEWIS

REUNIONS '94

continued

looking at the 13 guys from the Class of '24 who made it back. "The ones who come back to five- and ten-year reunions often come because they have something to brag about," Alumni/ae Fund Director Joseph Collins told us at my five-year reunion. "But after a certain age, they're just happy to be alive."

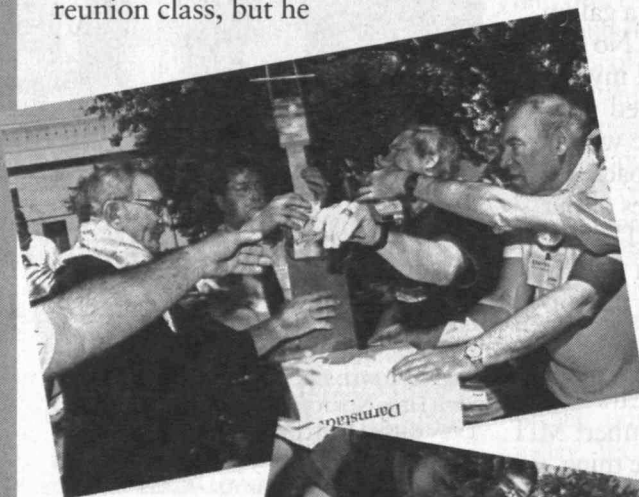
This being MIT, there's not much time to stand around clutching cocktails and murmuring, "So what are you doing these days?" Among the programmed distractions: a mini-2.70 contest; a team version of the old Freshman Quiz; tours of the shiny new research centers that have replaced the glue factories and vacant lots of upper Ames Street.

Older alumni were dazzled by the new offerings. "If I were a student today, I'd be at the Media Lab," enthused William J. McLelland, '47, after seeing some demos there. McLelland, retired from IBM, wasn't part of a quinquennial reunion class, but he

was lured back to Technology Day by an arts program that included physicist and Renaissance man Philip Morrison; art foundry owner and metallurgist Richard Polich, SM '65; composers John Harbison and Tod Machover; and I.M. Pei '40, who sent the audience away convinced that his Louvre project made him the greatest planner in Paris since Napoleon. All that in one Friday morning—with no tuition bill, for a welcome change.

On Friday afternoon, a crew of rowers from the Class of 1944 hijacked a shell from the Pierce Boathouse. The boathouse staff surely approved the escapade, but they stayed absent or camouflaged, lending a hacker atmosphere of trespass. "Isn't anybody supervising this?" one guest worried aloud. At the appointed hour, eight men in

FUELED BY RIBS
AND CHICKEN, AND
DECKED OUT IN
CLASS NECKERCHIEFS,
BARBEQUE-GOERS WERE READY
FOR THE HEAVY LIFTING: THE
ANNUAL ALUMNI/AE
CHALLENGE GAMES. AND
FUELED BY TRADITIONAL MIT
COMPETITIVE SPIRIT, MATURE
PROFESSIONALS OF ALL AGES
BEGAN TO RESEMBLE WIN-IF-IT-
KILLS-US UNDERGRADUATES.



T-shirts, shorts, and, in some cases, dress socks raised a fiberglass hull over their grey heads and bore it unsteadily out to the dock. "It's heavier than it used to be," one quipped, though he surely knew that the craft was in fact lighter than its wooden 1940s counterpart. The men grunted with relief when coxswain Austin Dodge gave the command to flip it over and edge it into the water.

The crew struggled to insert all the oars into the oarlocks—an inverted T indicated that one of the oars was upside-down, but nobody cared—and laced themselves into the sneakers attached to the boat fittings. Though their launching drill was rusty, they seemed to be coordinated at some deeper level: they were tuned to each other. ("Appearances change, but mannerisms stay the same," observed the Class of '47's McLelland. This explains how the most casual R/O Week acquaintances can recognize each other after a lapse of decades.)

When Dodge gave the command to push off and take a half stroke, the boat wobbled alarmingly. But no mishap marred this day, perfect for rowing: sunny, with a cool breeze over the sapphire Charles. Family and friends waved tissue-paper shakers and sang "Row, Row, Row Your Boat." Gradually remembering to feather the oars, the crew drifted over toward Boston University, appeared to run aground somewhere near the Hatch Shell, and finally recaptured its old rhythm and returned more smoothly than it departed. The spectators sang "Michael, Row Your Boat Ashore." Landing at the dock, the rowers had the look of marathon runners heading for the finish line. "If you had any plans for tonight, forget 'em," one called to his wife. But after a short cool-off period, many were

happy to climb back into the boat for a second run, with José Aguila as coxswain and several fresh rowers who had been waiting their turn. If you only raid the boathouse once every 50 years, you might as well make the most of it.

Members of the Class of '69 are more or less contemporaries of Bill Clinton and mirror his ambivalent blend of baby-boomer achievement and counterculture longing. Their college years were "a time of violent turmoil," according to reunion gift chair Denis Bovin: They were on



COMPETITIVE SPIRIT RUN AMOK? IT SURE LOOKS TO US LIKE A MEMBER

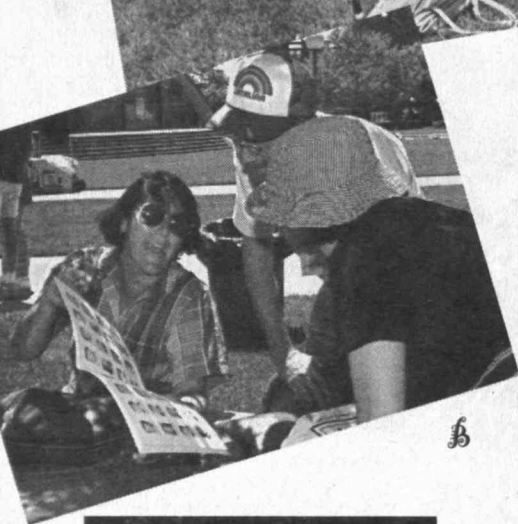
OF THE CLASS OF '74 IS STEALING THE PAPER AIRPLANE MATERIALS FROM THE CLASS OF '69's "TUITION RIOT" MAILBOX! THE 1974 TEAM IN THE 2.70 CONTEST, HOWEVER (IMMEDIATELY ABOVE), IS STRICTLY LEGIT.



A THE CLASS OF '84 WON THE "HEXAGONAL CLOSE PACKING" GAME, WITH A TOTAL SCORE BOOSTED BY ALL THEIR PROGENY.

B REUNION BOOKS WERE PRODUCED BY FOUR CLASSES, AND WERE WELCOMED BY ALL.

C TECHNICALLY A MEMBER OF THE CLASS OF '47, DAVID YABLONG FREQUENTLY JOINS OLD CLASSMATES AT REUNIONS OF 1944, AND HE CONTRIBUTED HIS ENERGY TO THE CLASS OF '64 ALUMNI/AE GAMES TEAM.



hand when Professor Jerome Y. Lettvin, PhD '47, debated Timothy Leary on the ethics of "turning on and dropping out." With Lettvin and Noam Chomsky, they turned the Sala de Puerto Rico into a sanctuary for a soldier who had gone AWOL to protest the Vietnam War. ROTC members in the class used to change out of uniform immediately after drill to avoid harassment, and Robert Wiener—now sporting a ponytail and a yin/yang earring—was discharged from ROTC for growing a beard. For many, the last semester at MIT was dramatically interrupted by the research strike

and teach-in held on March 4, 1969, by a group of professors in the process of founding the Union of Concerned Scientists.

Somewhat in the spirit of March 4, the Class of '69 held an open-mike class meeting on Saturday morning in the newly renovated Room 6-120. (I mourned the passing of the ancient black wooden seats where Richard Feynman and Norbert Wiener once sat, but at least the blackboards still move.) On this occasion, anyone who wanted to talk was allotted five minutes. Marc Davis, an

astronomer, spoke on his work on black holes ("giant movable objects from which you never return") while chalking 8.01 equations on the board ("I'm sure you remember this"). Eugene Mallove, a science writer who is one of this country's most passionate proponents of cold fusion, gave a talk on the phenomenon, complete with slides and handouts. Bob McGregor talked about solar cars and described the Clean-Air Car Race he organized in 1970. Bruce Anderson, another solar-energy activist and the president of Earth Day USA, proposed that MIT, "aimless" since the end of the Cold War, rededicate itself to sustainable use of resources. You could say these guys were concerned about how many miles they were getting to the gallon, but in a value-laden context.

At the end of the meeting, McGregor downplayed his classmates' activism, saying they had spent the last 25 years on their careers and their families. He urged them now to look at what they could do for the republic. A classmate who works for a federal agency accosted him in vigorous agreement: "Look, the disintegration of the Soviet Union started right in Building 33." (By which he meant

jet travel helped puncture the isolation of Soviet society.) "MIT can really play a big role, and very few classes have the kind of influence this one does. For a start, I know people who can get things on [Transportation Secretary] Pena's desk, or even on Hillary's."

I thought McGregor was rather hard on his class, which seemed extremely variegated compared to my 1980s cohort. Among the '69s who didn't show up for the reunion were Bob Swanson, founder of Genentech (who sent a letter urging classmates to pay attention to their children), Donald Scholz, founder of the band *Boston* ("He started out building music equipment, but then realized he could play as well as most of his customers," one classmate recalled), movie actor James Woods (who never graduated, but often mentions MIT in interviews), two carpenters, and a dulcimer maker. Robert Wiener, the class president, is a fantasy/science-fiction book publisher, somewhat to his surprise: "I always figured I'd be a programmer at Draper Labs."

The class even had a representative from the unemployed. A high-tech executive, forced out of his last position in a game of corporate musical chairs six months earlier, faced the class to talk about his job hunt. He told an engaging story about his worst job interview (at the apartment of an interviewer whose wife was going into labor) and noted that most of his 42 interviews to date came from MIT contacts. The next day, I spotted him with another man in jacket and tie, both hunched over a notebook computer in a Student Center lounge. "The thing people don't realize is that reunions are a fabulous place to network," says Anita Killian, '85, an Alumni/ae Association staff member.

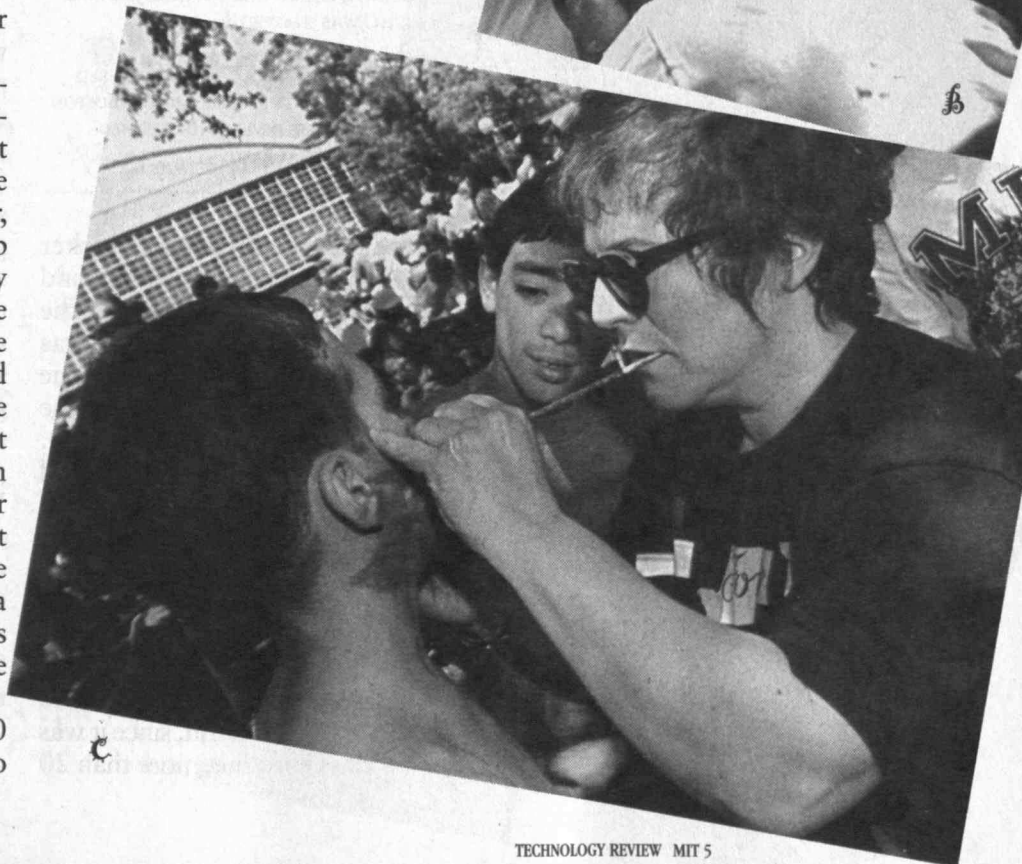
Though a number of the 50 women in the Class of '69 came to

the reunion, none chose to speak at the open mike. No one I asked had an explanation for this, but it seemed clear from their comments in the reunion book and in person that MIT had not been an entirely happy experience for these women. They remembered being shut out of sailing classes because men had a physical education requirement and women didn't; being shut out of the pool

A DAVID YABLONG'S WIFE, IVY, WAS ONE OF THE DOZENS OF REUNION-GOERS WHO OFFERED HER VISAGE AS A CANVAS FOR THE FANTASTIC IMAGINATIONS AND PALETTES OF FACE PAINTERS:

B NELSON LEE, THE ALUMNI/AE ASSOCIATION COMPUTER GURU, SHOWN WORKING ON SARAH WINSHALL, DAUGHTER OF WALTER WINSHALL, '64, AND

C JOANNE COOPER, OF MOBILIA GALLERY, A MASTER OF THE FACE-PAINTER'S ART, WHO VOLUNTEERED HER TIME.

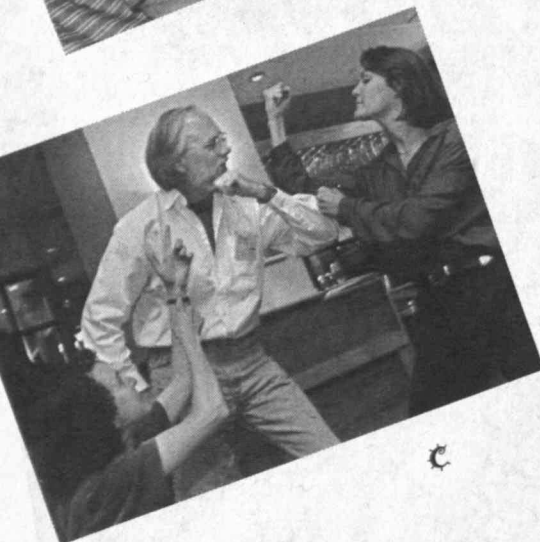




PRESIDENT CHARLES VEST AND HIS WIFE, REBECCA, ENJOYED THE GIFT OF A BOTTLE OF CHATEAU LA TEQUE '54 PRESENTED BY VINTNER DOMINICK SAMA (RIGHT) AND REUNION CHAIR BOB WARSHAWER.



B ANOTHER PRESIDENT'S RECEPTION WAS THE SETTING WHERE THE PHOTO OF CLASS PRESIDENT JOHN ISAACSON, '69 (FACING CAMERA) AND HIS WIFE, JEANNIE, (RIGHT) WAS SNAPPED.



C DAVID SNYDER, '74, VOLUNTEERED TO JOIN MEMBERS OF IMPROV-BOSTON WHEN HIS CLASS DINED AND LAUGHED AT THAI'S RESTAURANT.

because there was only one locker room. Sometimes there were unkind jokes: "When we got to MIT, the stereotype of the 'Tech coed' was that she was five by five, and the fastest slide rule north of the Charles," explained Linda Sharpe. She believes that her class helped break that stereotype, but vestiges of an underlying malaise persist. And MIT was probably a picnic compared to some of the jobs the women of '69 went on to.

The Class of 1984 could equally well consider itself a watershed in MIT's gender revolution, since it was the first class enrolling more than 20

percent women. On its watch, the last X-rated Registration Day Movie was shown, the first modern-day homecoming queen (Betty Beitz, '84) was crowned, and the first sorority was chartered. (Not everyone thinks this is progress; I am especially troubled about the idea of subjecting freshmen to the same divisive rush-and-flush procedure that sours the first taste of MIT for so many of their male classmates.) By the '80s, women—and minority students—were no longer de facto public figures on the Infinite Corridor. MIT had become an equal opportunity meat-grinder, for undergrads at least.

In their reunion album, the '84s answered questions never imagined by the framers of the "Baker Purity Test" (an underground quiz on experience with sex, drugs, and crime). Ten years after graduation, the checklist had matured: Have you earned an advanced degree? More than one? Been around the world? Changed careers? Gotten married? Children? (Score one point for each.)

The most enthusiastic returnees weren't necessarily the ones with the most "adulthood" points, or the ones who had high profiles on campus. "Some of the student leaders, the people who had had a lot of school spirit, aren't here, but a lot of people I didn't expect to see are," said Sandra Thomas, a Class of '84 officer who is now an MD working in research. Thomas's observation seems to be widely applicable: "The guy who was our senior class president has never shown up for a reunion—never," said Robert Wiener, '69.

After class elections, the new officers for '84 posed for photos on top of the Green Building. They didn't even have to hack their way up there: Steve Slivan, a research associate in the Department of Earth, Atmospheric, and Planetary Sciences, had a key to the roof, so it was all disap-

pointingly legal.

Succeeding reunions provide a new set of data points for each generation. The strobe flashes only once every five years now, yet the bursts seem to come closer and closer together. For some classmates, they have stopped: even the Class of 1984 already has seven names on the memorial page of its reunion book. The strongest survivors will gather perhaps a dozen times more to reassure and surprise each other. In the words of Alexander Brooks, a five-year-old accompanying his parents, Nat Brooks and Liz Snyder Brooks, both Class of '84, "Nobody can know the whole future." Indeed. And *that* is the number one reason for coming back. □

DIANA BEN-AARON, chief of research at Lingua Franca magazine, has no idea what she'll be doing when her class has its reunion in 1995.

"TWO CULTURES" CONVERGE IN KRESGE

BY DEBRA CASH

Engineers and artists both rely on "mens et manus," mind and hand, to express themselves in the world and get their jobs done. Technology Day '94, "For the Wonder of It All: The Arts at MIT," took a close look at these different, and often complementary, forms of creativity with a stimulating series of lectures that carried listeners from the era of the Stone Age axe to the triumph of the silicon chip, from prehistoric cave paintings of elk to holograms like the small one that graced the cover of the Alumni/ae Week brochure.

Ellen Harris, associate provost for

the arts and professor of music, said it best in her introductory remarks to the assembled alumni/ae: "Whether you worked in Doc Edgerton's strobe-photography lab, played in the symphony, sang in the glee club, or acted in a theatrical production, I am sure that at some point art touched your life at MIT and has continued to touch your life thereafter. Arts offer us discipline. Arts

A THE SATURDAY GUIDED TOUR OF MIT'S PUBLIC ART COLLECTION, INCLUDING CALDER'S GREAT SAIL IN McDERMOTT COURT, WAS A FASCINATING FOLLOW-UP TO THE FRIDAY TECHNOLOGY DAY PROGRAM, FOR WHICH THE KEY PLAYERS INCLUDED:

B A TRIO OF MUSIC PANELISTS (L. TO R.): JOHN HARBISON, LLOYD SCHWARTZ, AND TOD MACHOVER;

C T-DAY COMMITTEE CHAIR JORGE RODRIGUEZ;

D ASSOCIATE PROVOST FOR THE ARTS ELLEN HARRIS;

E ARCHITECT I.M. PEI; AND

F PHYSICIST PHILLIP MORRISON.





THE CLASS OF '34
DINNER AT THE MIT
MUSEUM GAVE
CLASSMATES TIME TO ENJOY
EXHIBITS AND EACH OTHER'S
COMPANY. KITTY CARLISLE HART
AND PLAYWRIGHT CUM MIT
FACULTY MEMBER A.R. GURNEY
OFFERED A REUNION '94
EXCLUSIVE: A PRODUCTION OF
GURNEY'S *LOVE LETTERS*.
AND 50-YEAR REUNION-GOERS
WERE LIGHT ON THEIR TOES AT
THE DINNER DANCE AT
WALKER MEMORIAL.

offer us imagination. They offer us the flexibility of pursuit where there is not [just] one right answer."

President Charles Vest noted that the arts are a paradigm for the creative process that occurs in any intellectual pursuit. "When we develop our ability to think creatively, we are able to find new solutions to the problems on which we are working, both in laboratories and in other aspects of our lives."

Vest explained that today's MIT curriculum maintains a focus on basic science and engineering expertise, and on the analytic tools those disciplines call for, but at the same time increasingly emphasizes design

and synthesis—skills exemplified by the arts. These were the characteristics most under discussion as the speakers addressed the spectrum of what Harris called "playful engineering and serious art," and offered some responses to the question: "What is the role of the arts in an MIT education?"

Physicist Philip Morrison, Institute Professor emeritus, was the first speaker in the day's main program, and he offered an intellectual travelogue of slides. With typical thoroughness he started with a collection of stone axes from East Africa that were, "to be generous, a few thousand centuries old," and indicated their dispersion across the world. A later slide showed the Eiffel Tower, a great feat of structural engineering built as a decoration for the 1889 World's Fair. His wife, Phyllis, had drawn slashes of fireworks across another copy of the same slide in colorful markers, leading Morrison to point out that there is a difference between the Eiffel Tower, a photograph of the Eiffel Tower, and an augmented image that shows something that exists only in the artist's mind. Morrison called for more collaborative efforts by artists and engineers in the area of image manipulation, saying, "I cannot think of a better way of understanding that problem, of conquering it, than by having people who know both sides of the operation, who have studied the arts to see how much you can do to make entertaining and wonderful things that don't exist, but also how much you can do to represent scrupulously and meticulously the data of the real world."

The Eiffel tower was a natural lead-in to the remarks of architect I.M. Pei, '40. In a genial, almost talk-show format with Dean of Architecture William Mitchell, Pei treated the Kresge Auditorium audience to a free-ranging conversation about the

behind-the-scenes tribulations of renovating the Grand Louvre museum in Paris and creating of the controversial glass pyramid in its courtyard. He focused equally on the challenges associated with architectural design, construction engineering, and the politics of working through the French bureaucracy.

"When you build a modern museum . . . about 50 percent of exhibit space has to be matched by 50 percent supporting spaces—conservation laboratory, restaurants, public reception areas, toilets," Pei explained. For all its power as a French national icon, the Louvre, built as a fortress in 1202 and then transformed into a palace, was notably lacking in such spaces—the antithesis of a user-friendly environment.

By now it's common knowledge that Pei stashed much of the new space unobtrusively underground, and conceived of a startling glass pyramid as a roof and entry to the new facilities. "If this is going to be the main entrance to the Louvre," he noted, "it cannot be just a subway entrance."

The T-Day audience went from Pei's consideration of the spaces in which the public can experience art, to Richard Polich, SM '65, who illuminated the processes by which much public art is fabricated. Polich is the owner of a foundry in New York State devoted to sculpture (See "Techno-aesthetic Entrepreneur," TR May/June 1994), and he discussed the transition from Renaissance-era techniques for casting metals and creating monumental sculptures to gasoline-powered cranes and computer-driven lasers. Polich made clear distinctions between the exploratory, open-ended creative process of the artist; the problem-solving science associated with fabrication of an object to scale and in the appropriate materials; and new

engineering techniques that may be created if existing technology is inadequate to the artist's vision.

Polich noted that "an idea in art is only good once. Thereafter, it is repetition. But a good engineering solution can be used many times over and over until a better solution presents itself." What may appear to an engineer to be capriciousness and self-indulgence on the part of the artists, Polich said, is really the lat-

A WHEN THE CLASS OF '74 WAS ENTERTAINED BY A LOCAL IMPROVISATIONAL COMEDY TROUP AT A CASUAL ETHNIC RESTAURANT, THE DRESS CODE WAS RELAXED, THE TONE ELECTRIC.

B & C THE NIGHT THE CLASS OF '44 WAS AT THE PRESIDENT'S HOUSE, ON THE OTHER HAND, WAS MORE FORMAL AND LOW-KEY. BUT THE FESTIVITY WAS ALWAYS GENUINE, THE COMFORT LEVELS HIGH.



A



B



C



A TECH NIGHT AT POPS '94

WAS QUITE EXTRAORDINARY—AS IN THE CONDUCTING DEBUT OF CORPORATION CHAIR AND 40TH REUNION ATTENDEE PAUL GRAY, '54,

B AND IN THE PERFORMANCE OF RAVEL'S *CONCERTO IN G* BY NATIONALLY CELEBRATED CONCERT PIANIST AND MIT LECTURER IN MUSIC DAVID DEVEAU.

C BUT THERE WAS PLENTY OF ALLOWANCE FOR THE TRADITIONAL PLEASURES—AS IN A CHAT FOR '54 CLASSMATES HARVEY STEINBERG AND RON KURTZ

D AND A CONGENIAL PRE-POPS DINNER.

ter's response to the pressure to avoid repetition.

T-Day returned to a talk-show format to present two members of MIT's music faculty—the 1994 Kil-

lian Award winner, Pulitzer holder, and MacArthur Fellow John Harbison and fellow-composer Tod Machover—with Boston classical-music commentator Lloyd Schwartz (himself a Pulitzer recipient) serving as "host." It was savvy casting, with a terse Harbison playing straight man to Machover's more voluble presence, each shown to best advantage in the spotlight of Schwartz's knowledge of the musical territory.

Both faculty members have written pieces for cellist Yo Yo Ma, and film clips of rehearsals with the world-class artist offered the audience a glimpse of the different styles and approaches of the two composers. Harbison writes his music for symphony orchestra and traditional Western instruments, while Machover pushes the edges of technology to see if computer-based hyperinstruments can offer artists new expressive resources. (Ma is stellar in both domains.)

For all his devotion to traditional instrumentation, Harbison is a staunch supporter of the innovations explored by his colleagues. "Some of us who started out here in music at MIT in Klaus Liepmann's days (1947–72) were aware that . . . MIT would need to develop in directions appropriate to [its] resources," Harbison said. "Our students are extraordinarily diverse. Some of them really just want to learn how to play a Schubert trio, and others really want to find out on Day One how the computer can help them as artists."

Both composers agreed that MIT has been an unusually hospitable place for an artist to work and to teach, an institution that nourishes "the wonder of it all" wherever that delight is found. □

A SPECTACULAR VOTE OF CONFIDENCE

BY JOHN MATTILL

Fifty years ago the events of Pearl Harbor changed the lives of members of the Class of '44 virtually overnight. All who were physically qualified took their places in the armed forces on land, on sea, or in the air. Many left MIT with their studies incomplete. Thirty-two never returned.

Twenty-five years later their counterparts in a very different student generation and MIT class "attended MIT in a time of violent turmoil—both domestic and international," in the words of their reunion gift co-chair. "We were formed in the crucible of an extremely unpopular war and tempered by the re-evaluation of relationships between races, religions, and genders," Denis Bovin, '69 observed.

For these two classes—1944 and 1969—this year marked a unique conjunction—the only time both would return for major reunions at a place where each had life-altering experiences that could be colored but not erased by the events swirling around them. As June 1994 approached, it became obvious that near-record numbers of both classes would be on hand. The majority

made it to the Technology Day luncheon at the Johnson Athletic Center, helping to swell attendance to an all-time high of 2,500.

Presiding at Commencement on May 27, less than two weeks before the 50th anniversary of D-Day, Paul E. Gray, '54, chair of the Corporation, spoke in tribute to the class of

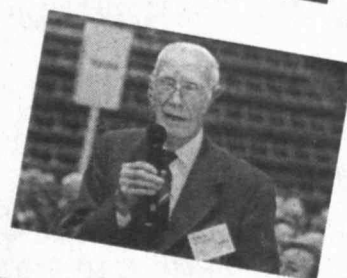
A TECHNOLOGY DAY HIGH POINT:
ANNOUNCING REUNION-GIFT TOTALS,
A PRIVILEGE ACCORDED GIFT CHAIRS:

A DENIS BOVIN, '69,

B RONALD KURTZ, '54,

C THE LATE EDGAR EATON, '44,

D AND RICHARD SHEA, '24.



LA RELATIVELY NEW FEATURE OF T-DAY: THE ALUMNI/AE ASSOCIATION'S STUDENT RECOGNITION PROGRAM, THROUGH WHICH LOCAL HIGH SCHOOL STUDENTS ARE RECOGNIZED FOR THEIR ACADEMIC, SOCIAL, OR CIVIC MERIT. THEIR DAY INCLUDES A MEETING WITH MIT PRESIDENT CHARLES VEST.



\$28 MILLION IN 1994 REUNION GIFTS

THE FOLLOWING REUNION GIFTS WERE ON RECORD AS OF JULY 1, 1994.

CLASS	GIFT TOTAL	GIFT CHAIR(S) OR CLASS AGENT
1924	\$6,056,000	RICHARD F. SHEA
1929	\$3,625,000	GORDON BOWIE
1934	\$2,540,000	HENRY B. BACKENST
1939	\$2,740,000	ERNEST R. KASWELL
1944	\$6,152,000	EDGAR P. EATON, JR., E. ALFRED PICARDI, AND EDWIN G. ROOS
1949	\$1,409,000	EUGENE M. WROBLEWSKI
1954	\$4,641,000	RONALD A. KURTZ
1959	\$710,000	ARTHUR J. COLLIAS
1964	\$1,227,000	ANDREW J. SILVER AND LEON M. KAATZ
1969	\$2,378,000	DENIS A. BOVIN AND ROBERT A. SWANSON
1974	\$102,000	HOWARD D. SITZER
1979	\$102,000	RICHARD KOVALCIK, JR.
1984	\$51,000	DAVID S. MACKAY
1989	\$29,000	NANCY L. GILMAN

The 60th, 65th, and 70th reunion gifts include gifts and bequests received in the 5 years leading up to reunion. The 25th, 40th, and 50th reunion classes include gifts in the 5 years prior to the reunion and pledges payable for the following 5 years. All other reunion gifts include only gifts received in this fiscal year.

1944, whose members were back to march in the procession. Having entered MIT expecting the usual four-year program, most had been inducted into the military within less than three years—long before receiving their diplomas. It was “the greatest disruption due to World War II of all the wartime classes,” said Gray. The marchers, so many deprived of their own Commencement by military orders 50 years ago, received an ovation from the estimated crowd of 10,000 graduates and guests at the 1994 ceremony.

Back in Cambridge on Technology Day, the Class of '44 hit another high note: Their 50th reunion gift came to \$6,055,819 (reflecting the 10-year accumulation of gifts and pledges from the five years leading up to and following the reunion). Under the leadership of gift chair Al Picardi, the class achieved 71 percent participation, and class president Edgar Eaton particularly acknowledged the effective role that Ed Roos, the major gift co-chair, had played in their campaign.

For all their tumultuous undergraduate years, the Class of '69 demonstrated classic gratitude for their educations. “Whatever we were when we came here, we left changed and enriched by what we did here,” said Denis Bovin, who chaired the reunion gift committee with Bob Swanson. The class thought of its \$2,334,500 reunion gift as both an installment on its debt to MIT and “downpayment on future achievements,” Bovin said. It was the largest 25th reunion gift in six years, with fully two-thirds of the class participating—a testament to the pleasures of suppressing an analytical education in favor of “asking friends and colleagues for outrageous amounts of money,” he quipped. The class reunion project

was a scholarship fund honoring Paul Gray, who was president for 10 years before moving on to head the Corporation.

The Class of 1954 also acknowledged Gray's longtime leadership in announcing a 40th reunion gift of \$4,610,255. Ronald Kurtz, reunion gift chair, noted that "insightful leadership and plenty of money" are required to attract the very best faculty and students. "Fortunately," said Kurtz, "we've had plenty of the former (particularly in recent years with Paul Gray and now Chuck Vest), but there never is enough of the latter." The class contribution to that endless need for resources included \$624,400 for a career-development professorship.

In a special presentation, Richard F. Shea announced a 70th reunion gift of \$3,899,821 from the Class of 1924, for which he was reunion-gift chair. It was the class's way of saying thanks, said Shea, for a priceless education for which MIT then charged the modest tuition of \$1,200 for four years—and of which he paid only \$270, the balance being covered by scholarship.

Nine other reunion gifts (see box) announced by Richard A. Jacobs, '56, who presided at the Technology Day luncheon as president of the Alumni/ae Association, brought the total of 1994 reunion giving to \$28 million. In addition, the new Class of 1994 had pledged total gifts of \$44,008 by its fifth reunion in 1999, Jacobs said. And with nearly a month to go, Jacobs noted, the 1994 Alumni/ae Fund was closing in on several records: total giving came to \$22.99 million from 28,205 donors, including upwards of \$3.5 million from some 35 per-

cent of the alumni/ae whose first MIT degree is a graduate degree (See "Alumni/ae Fund Over the Top," page MIT24).

President Charles M. Vest called these gifts a "spectacular" vote of confidence in MIT from those who know it best. Like the undergraduates who celebrated Commencement a week before Technology Day, Vest noted, he was completing his fourth year as president. The most important lesson of those four years, he said, is the same for him as for the undergraduates who arrived at MIT the same time he did: "how to couple intellectual rigor and discipline with creativity and innovation, [thus gaining] the self-confidence to approach virtually any challenge we encountered."

The highlight of Vest's Technology Day report was MIT's successful challenge of the Justice Department's "improper and intrusive attack on our commitment to the system of need-based financial aid"—the so-called "overlap suit." The response from the assembled graduates was a wave of applause. Though several trends of the last four years cited by Vest were less positive—the diminishing federal commitment to higher education and research, increasing violence in urban America, the continuing malaise of primary and secondary education—he is optimistic, he said.

"Communication, engagement, and integration are the dominant themes I see ahead. And with these will come understanding, problem-solving, and a greater sense of shared humanity, values, and destiny," said Vest. "Though the world may be somewhat less predictable and stable, the field of opportunity to discover, learn, grow, and serve has never been so great," he declared.

Although this was Vest's fourth

appearance at a Technology Day gathering, it was his first as a *member* of the Association of Alumni and Alumnae of MIT: just 10 minutes before he rose to speak, Vest had been surprised and apparently delighted by Jacobs' announcement that the president had been named an honorary member. That honor, said Vest, reinforced his commitment to MIT "in yet another and profound way." Honorary membership was also awarded to John T. Preston, MIT director of technology development, who was cited for turning the Institute's Technology Licensing Office into "one of the nation's most successful programs [for] moving potential products from university research laboratories to the private sector." Preston responded that his six years in this assignment for MIT have been extraordinary—"an absolute blast for me to be hanging around this place."

There was special recognition for four other members of the Technology Day luncheon audience:

- Malcolm Burroughs, '20, who came from Topsfield, Mass., to be the oldest alumnus present.
- Maung M. Sein, SM '61, of Singapore, who traveled farthest.
- Jorge Rodriguez, '60, chair of the 1994 Technology Day committee, which worked with Associate Provost Ellen Harris and the Association staff to plan the events centering on the arts at MIT. (Rodriguez in turn announced his successor for 1995, James Stark Draper, '62.)
- R. Gary Schweikhardt, SM '73, who was to take over as the 100th president of the Alumni/ae Association on July 1, the first president who holds only a graduate degree from the Institute. □

1901-1994

JULIUS ADAMS STRATTON '23

Walking in the Footsteps of William Barton Rogers



From time to time there comes a man whose life is a glittering expression of noble ambition nobly fulfilled. Such a man was Julius Adams Stratton, '23, 11th president of MIT, who died on June 22 at age 93. It is remarkable, more, that Jay Stratton crystallized and articulated his ambitions when, in the language of his youth, he was a mere stripling of a lad.

Following his graduation with a bachelor of science in electrical engineering, his parents, at some sacrifice, supported him in a year of graduate study at the Universities of Grenoble and Toulouse. "I came to Europe with this double purpose," he wrote while abroad: "to broaden my education by the study of those things for which I had felt the want at Tech—of literature, languages, and art—and to take time to think about the course I was to follow in the future." And think he did, reporting on his state of mind and his plans for the future in a six-page discourse to his parents.

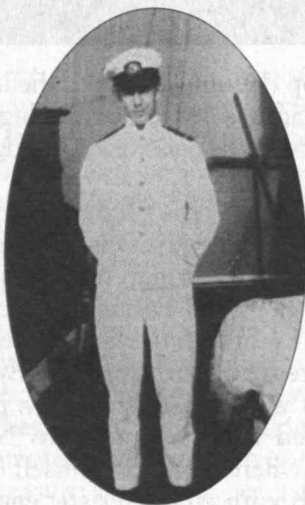
Two passages leap from those pages: "My only encouraging hope has been that there was a place in the world for a man with a little greater vision, a little larger view, who could discover the trend of science and philosophy, and thereby more advantageously direct their progress. There, crudely, is my ideal and my ambition, as it always has been, as it is as I write, and as I feel that it always will be." And several paragraphs later, "I may confess to you that my secret desire would be the administration one day of such an institution as MIT."

Thus resolved, he returned to Tech for a master's degree in electrical engineering, cementing what was to become a virtually unbroken relationship of dedication, service, love, and fulfillment between man and institution.

Jay's coming to MIT in the first

BY CLAUDE W. BRENNER, '47

place was an accident—a story he loved to tell. Too young at 16 to enlist during World War I, he responded to the country's desperate need for radio operators by enrolling in a night course at the YMCA near his home in Seattle to qualify for an operator's license. By the time he passed his exams, the war had ended, but his effort was not to be wasted. In the late winter of 1919, following his graduation from high school, he signed on as an



MIT undergraduate Jay Stratton in 1922, on his last voyage as a ship's radio operator, first class, bound for China and the Philippines.

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apprentice operator on a number of coastal freighters. By early summer he had qualified as a commercial radio operator, first class, and was posted aboard the *Western Glen*, carrying steel rails for the Manchurian railroad to Dairen via Kobe and Osaka. The ship's return was to have brought him back in time to enroll in the fall as a freshman at Stanford; Yale was his second choice. But nature intervened.

On the homeward journey, his ship ran into a typhoon, and Jay was on duty in the radio shack when he picked up an SOS from another American ship. The *Western Glen* steamed to the rescue, herself running aground several times as she shepherded the disabled ship to port. After coaling at Kobe, his ship again set sail for Seattle, only to limp back to Kobe for repairs after an explosion in the engine room that also ended Jay's hope of attending Stanford or Yale.

There was nothing left but to enroll at the University of Washington, where he decided to study electrical engineering but was equally fascinated with the sciences. A fellow student suggested that the best place for him was MIT. "Where's that?" Jay responded. "You know—Boston Tech." That description didn't help much, but Jay looked into the Institute, applied, and was accepted for entry in the fall of 1920. Characteristically, he made his way to Boston by sea, earning his passage as radio operator aboard the *Eastern Pilot*, bound for New York from Tacoma via the Panama Canal.

Jay's intimate connection with MIT remained unbroken for the rest of his life, save for the aforementioned sojourn in France and two years (1926–1928), when he earned a doctorate in mathematical physics at the Eidgenössische Technische Hochschule (Swiss Federal Institute of Technology) in Zurich. He returned to the Institute as assistant professor of electrical engineering, then transferred into the Department of Physics and proceeded up through the professorial ranks.

Much of Jay's research concentrated on the propagation of short waves, about which less was known than the long waves then generally employed in radio transmission. His work on microwaves and that of his

Stratton Remembered

continued

In 1967, Dr. Stratton chaired a commission whose work—published in the final report presented to Vice-President Hubert Humphrey—resulted in the formation of the National Oceanic and Atmospheric Administration.

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Institute, returning from time to time to meet the demands of his role as a newly elected life member of the MIT Corporation. Despite the Corporation bylaws requiring that he assume emeritus status at age 75, Jay continued to serve as a member of the Corporation Visiting Committees to the Departments of Physics and Humanities until 1989.

The project that filled the remainder of his retirement years was an extensive two-volume history—as yet unpublished—of MIT in the nineteenth century. Meticulously researched, the book examines the intellectual ferment in Europe and in this country in the 1850s that inspired William Barton Rogers' dream of an education that would combine science and technology with general culture. The book traces the founding and chartering of MIT as an institute embracing a Society of Arts, a Museum of Arts, and a School of Industrial Science, and concludes with the early years of the Institute through the presidency of James Mason Crafts in 1900. Jay's assistant for his last 35 years, Loretta H. Mannix, collaborated with him and is his coauthor on the book.

Throughout his life Jay was a loyal and devoted alumnus, actively supporting and participating in the affairs of the Alumni/ae Association. He was a frequent speaker at meetings of the Alumni Council, clubs, and other groups, practicing what he preached: In the first major address of his presidency to alumni and alumnae, at the Chicago Regional Alumni Officers' Confer-



colleagues foreshadowed later developments in radar and the burgeoning of electronics after the war. He published numerous scientific papers and wrote or collaborated on four books. His first book, *Electromagnetic Theory*, written in 1941, became a standard text and was later published in Italy, France, and Czechoslovakia.

In 1949 he was named MIT's first provost, followed two years later by a concurrent appointment as vice-president. He was named chancellor in 1956 and became acting president in 1957 when President James R. Killian, '26, was appointed science advisor to President Eisenhower. In January 1959, Jay assumed the presidency of MIT—fulfilling the secret desire of his youth. It is a measure of his regard for alumni and alumnae that he asked that his inauguration be held on Alumni Day (now Technology Day) in June of that year.

He retired in 1966 at the mandatory age of 65, having given major impetus to the realization of William Barton Roger's 1846 vision for MIT: "A great institution comprehending the whole field of physical science and the arts. . . [that] would soon

overtop the universities of the land in the accuracies of its teachings in all branches of positive knowledge."

Following his retirement as president, Jay was promptly elected chairman of the board of the Ford Foundation, capping 11 years' service as a trustee of that prestigious organization. By no means a sinecure, this new post required that Jay move to New York, where he threw himself into the job with characteristic energy and innovation. He returned to Cambridge in 1971 with the accolades of his fellow trustees: "He leaves the Foundation stronger than he found it, and all who care for its work are deeply in his debt."

In 1967, Jay was named by President Lyndon Johnson to chair the newly established Commission on Marine Science, Engineering and Resources, whose landmark report, "Our Nation and the Sea," resulted in the formation of the National Oceanic and Atmospheric Administration—and in a list of honors acknowledging Jay's contributions to marine science and policy.

Throughout that stage of his career, he maintained an office at the

The inauguration of Julius Stratton as president of MIT in 1959 was the culmination of a dream he'd held all his adult life. Inset: Chairman of the Corporation James Killian presents Stratton with a copy of the MIT Charter.

ence in October 1959, he said that "any college that fails to cultivate the interests of its alumni is neglecting the very roots of its support—not of money alone—but of the firm, warm loyalty that can show itself in such countless ways. And the alumnus, in turn, who allows his ties to his college to weaken or break away is losing something of priceless value that he has rightfully earned and that might be a source of pride and profit to him all his life."

In his curriculum vitae, Jay describes himself quite simply—educator. One paragraph in his inaugural address encapsulates the philosophy that would govern his presidency: "No task," he declared, "is presently more urgent than the education of youth. . . . The highest goal to which a university may aspire is that its sons and daughters shall be leaders in art and science and that their influence shall be brought powerfully to bear for the welfare of mankind. With this affirmation of purpose, I think we must strive to develop more effectively the creative, imaginative, constructive powers of our students. . . . We must bring about a more productive integration of the humanities and social sciences with the physical sciences and engineering. And I am convinced that we must endeavor to impart to our students a better understanding of the professional state and of the values it implies."

As the member of a Committee on Educational Survey who was largely responsible for preparation of its 1949 report, Jay had one of his early opportunities to act on his values:

that report was pivotal in raising the humanities from an academic division to the School of Humanities and Social Sciences, on a peer level with the other schools. During his tenure as president, the Departments of Psychology and Political Science were established, along with a distinct program in philosophy that has since grown into the Department of Linguistics and Philosophy. These specialties joined the Departments of Humanities and Economics to add immeasurably to the breadth of MIT's youngest school.

"My plea," Jay later declared in an address to the American Association of Museums, "is for balance, for a fullness and roundness of the educational experience. Let the student learn to respect and to cultivate his ties to the physical world, to nature, and to experiment. Let him find in art the counterpoise as well as the companion to the intellect, so that he may learn to see and feel as well as to think. For in the completeness of life, human feelings must be added to human thought. Without that completeness, without healthy bonds to art, to nature, and to man, scholarship—however impressive—ultimately becomes little more than an

intellectual exercise."

Jay came readily to a personal interest in the humanities. His father, Julius, a lawyer by profession and briefly a superior court judge, was an English classicist and Shakespearean scholar by avocation. His mother, Laura, was a concert pianist. When Jay was 6 years old, his parents moved to Europe, settling in Berlin where Jay started school and learned to speak German. In this environment—the only child of educated and cultured older parents, growing up in one of the great cultural centers of Europe—Jay's love for arts and letters was assured.

Jay reflected on the role of humanities at MIT in his farewell Commencement address in 1966. "In my own view, the humanities have become central to our endeavors rather than merely peripheral. They cannot be set apart—they must put down deep roots of their own for an authentic growth in our special environment. We here are primarily concerned with the rational processes of the mind. We deal in large measure with facts and figures, with elements that are tangible and concrete. These traditional concerns *need* a leavening of the arts and the humanities



Stratton Remembered

continued



Dr. Stratton was joined by (from left) daughters Laura, Cary, and Catherine (far right), and his wife, Catherine N. Stratton, for the dedication of the Julius Adams Stratton Student Center in 1966. Inset: Undergraduate Association President William Byrn, '66, flanked by Stratton and Killian, expresses MIT students' pleasure in the building's name.

that we may become truly professional and abundantly aware of our heritage of ideas, of the sweep of history, of the power of art and literature. For these give balance to the range of our knowledge and understanding and a broader import to the works of science and technology that will constitute our own special contribution to the progress of man."

In these last words he echoed once again his concern that scientists and engineers develop a keen awareness of their special role in and obligations to society. He first publicly framed this conviction in the address he delivered at Saint Francis Xavier University in Antigonish, Nova Scotia, on the occasion of his being granted an honorary degree in 1957. "We who are scientists and engineers by profession must not isolate ourselves from the great issues of the day, even though they seem to lie outside our sphere of special competence. The very fact that science has become a dominant force in modern society imposes upon us a special obligation as citizens to share responsibility for the moral, political, and economic problems that beset us all."

He elaborated on this refrain repeatedly—in his 1964 Commence-

ment address, for example: "Science, technology, and society now form a tightly coupled system. . . . It is only by an examination of the impact upon society as a whole that we can pass judgment on the degree of progress (of technology)." He went on to voice a thought that is even more relevant today: "Our society—the body politic—is subject to old, chronic disorders and to new ailments. These diseases of the system are emerging in increasing numbers; and we must be courageous in recognizing that they are themselves the byproducts of our highly technical environment."

These concerns with the humanities and the arts, with the conscience of the scientist and engineer, were clearly concerns with the education of the MIT student as citizen. Yet they did not mask the fact that Jay, himself a scientist and engineer, was above all committed to assuring the preeminence of science and engineering at MIT.

As a young professor of physics, following the initiatives of President Karl Compton and Professor John Slater, the department chair, Jay joined other faculty members recently re-

turned from Europe in resisting the traditional role assigned to physics—that of handmaiden to and handbook for the engineers—and promoting the study of physics in its own right. "Science," Jay later observed, "has a dual nature. It is indeed the foundation of all technology. But it gives also the framework of philosophy. It is the reference point from which we inquire into the meaning of our existence and the nature of our universe and the limitation of our powers."

Jay was the founding director of MIT's first interdepartmental laboratory, the Research Laboratory of Electronics (RLE). RLE was an outgrowth of the famed Radiation Laboratory of World War II, which was itself a successful marriage between physics and engineering. RLE served as a model for some 50 interdisciplinary laboratories and centers that were to follow in the next four decades.

Yet as a champion of research, Jay never lost the perspective of MIT as an educational institution. "The importance of research of any kind, pure or applied, within the confines of a university lies not simply in the advancement of knowledge," he wrote, "but also in the extent to which it serves to develop the creative powers of the student. It is precisely in this relation to the student that the function of research in the university differs from that of the industrial organization and the independent laboratories."

Jay received many honors—degrees, medals, fellowships—and he



Professor of Physics William Allis, '23, (right, above) was on hand for Jay's retirement dinner in 1966, where Stratton was presented with a telescope. Allis was a frequent traveling companion and took the photo of Stratton with a group of Jivaro Indians on a 1932 adventure in Ecuador.



was the recipient of 17 honorary degrees, conferred by some of the most prestigious universities in the world, including Cambridge, Leeds, Harvard, Brandeis, Johns Hopkins, and Notre Dame. The first honor he received was the most august: this country's Medal for Merit, awarded in 1946 for his wartime service as consultant to the secretary of war. He was inducted as an Officer in the French Legion of Honor, invested as a Knight Commander of the Order of Merit of the Federal Republic of Germany, and inducted into the Order of Boyacá, the highest honorary distinction given by the Republic of Colombia.

The Institute of Radio Engineers (now the IEEE) granted him the Medal of Honor, followed by the IEEE Centennial Medal; and the British Institution of Electrical Engineers awarded him the Faraday Medal. He received the Boston Medal for Distinguished Achievement, and was elected to Honorary Fellowship of the Manchester College of Science and Technology in England.

Jay was elected to membership in the National Academy of Sciences in 1950. In 1955, in the aftermath of the McCarthy hearings, he chaired

the academy's committee considering loyalty oaths for those involved in unclassified scientific research; the committee's recommendations against special loyalty requirements were accepted by the Eisenhower administration. During Jay's tenure as vice-president of the academy, 1961–1965, he chaired a committee that led to creation of the National Academy of Engineering, of which he became a founding member.

Of all Jay's honors, he was unquestionably proudest of that accorded him by his own beloved MIT in the final months of his presidency. Jay was on a fishing vacation in Colorado when he was notified that at the request of the undergraduate body, the Corporation had voted to name the new Student Center in his honor. The fact that the students, reciprocating Jay's deep feeling for them, had wanted their building named for him was particularly gratifying. The bronze bust of him that graces the central foyer was a gift of the Undergraduate Association.

Redesigned and revitalized in 1988–89, the Julius Adams Stratton '23 Student Center now boasts a

new central lounge named for Jay's wife of nearly 60 years, Catherine N. Stratton, a compliment not only to their partnership but to Kay Stratton's own unique contributions to the cultural and social life of the Institute. Jay was perhaps prouder of that than even of his own recognition.

The building stands as testament, in part, to Jay's words inscribed on the central interior facade—words taken from his inaugural address: "As a great educational institution, we shall fall short of our mission if we fail to inspire in our students a concern for things of the spirit as well as of the mind. By precept and example, we must convey to them a respect for moral values, a sense of the duties of citizenship, a feeling for taste and style, and the capacity to recognize and enjoy the first-rate." It would have pleased Jay to know that Edward L. Friedman, '50, professor emeritus and recently retired chairman of the Department of Electrical Engineering at the University of Hartford, quoted those words—from memory—each term at the opening lecture of each of his classes.

Jay's fellow alumni/ae continued to honor him in other ways. In 1967 the Alumni/ae Center of New York

Stratton Remembered

continued



Few of us have the privilege of looking our memorials square in the eye. Dr. Stratton contemplates his bust, which now graces the building that bears his name. The sculptress is Beatrice Paipert, '51.

presented their Silver Stein Award, "in recognition of distinguished and creative contributions to one's profession," and in 1968 the Alumni/ae Association awarded him the Bronze Beaver, the highest honor the Association can bestow. In 1980, William R. Hewlett, '36, a founder of the Hewlett-Packard Co. and a former student of Jay's, endowed the Julius Adams Stratton Professorship, to be held alternately by a faculty member from the Department of Electrical Engineering and Computer Science and the Department of Physics.

Much as his achievements, words, and honors bear witness to Jay's long- and deeply held sense of mission, they do not fully convey his humanity, his sensitivity, his commitment to the whole community in which he lived and worked. Jay was a gracious man, courtly and self-effacing, clearly approachable, and these qualities were perceived and valued by

all who came within his orbit. His concern extended, not surprisingly, to his neighbors in the larger community. Once, after a noisy student demonstration in front of the President's House, protesting that year's announced increases in tuition, Jay apologized—on his own behalf, not the students'—to his neighbors in the apartment building at 100 Memorial Drive for the disturbance.

He was, of course, a family man. He and Kay were married in 1935 after a four-month courtship. Their three daughters—Catherine, Cary Boyd, and Laura Thoresby—became very much part of Institute life during their seven years' residence in the President's House. They shared with their parents the pleasure of the occasional weekends and summer weeks at the family home, Toby Hill, in South Newfane, Vt., where they often entertained groups from MIT. Kay herself was keenly interested in the arts and humanities and still chairs the Annual Meeting Commit-

tee of the MIT Council for the Arts. She is also the prime mover behind a lecture series on successful aging now sponsored by the MIT Women's League and named in her honor.

At the time of Jay's retirement from the presidency, his predecessor, Jim Killian, then chairman of the MIT Corporation, said of him, "As teacher, scholar, and administrator, he has cultivated and helped to fulfill MIT's highest aspirations. By his gift of lucid exposition, he has made clear complex problems and policies and conveyed the objects, aims, and spirit of MIT to a wider audience. His catholicity of mind has given him the qualities of a humanist as well as those of a scientist, those of an administrator as well as those of a scholar."

But perhaps Jay's own words serve best as his epitaph. "The mark of a truly educated man is an attitude toward learning, an intellectual style. To his treasury of information, he adds a way of going about things, a viewpoint toward life and the world in which we live. He carries with him a spirit of intellectual enterprise such that he continues throughout his whole career to deepen and broaden in knowledge and understanding." And finally, "In the long run, MIT shall be remembered for the men and women we produce and for their influence on society." MIT shall be remembered for having produced Julius Adams Stratton, and for all his great works. □

A MEMORIAL SERVICE FOR FORMER PRESIDENT JULIUS STRATTON WILL BE HELD AT 1 PM ON SEPTEMBER 21 IN KRESGE AUDITORIUM. HIS FAMILY WILL GREET MEMBERS OF THE MIT COMMUNITY AT A RECEPTION TO FOLLOW IN MCCORMICK HALL.

FROM ALUMNI/AE
ASSOCIATION PRESIDENT
GARY SCHWIEKHARDT SM'73

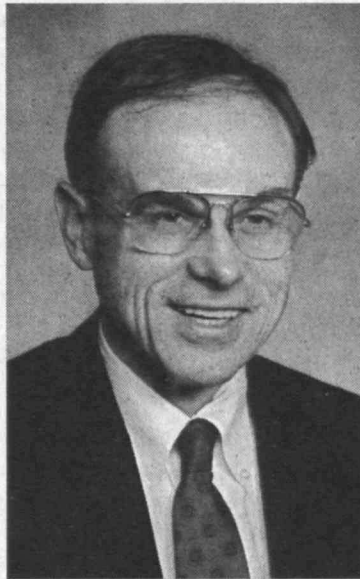
The Technology Day luncheon in the Johnson Athletic Center is always an important occasion for incoming presidents of the Alumni/ae Association.

Although we officially take office on the first day of the new fiscal year (July 1), the T-Day luncheon is the time for the handing off of the baton—or in this case, the gavel—from our predecessors. For me, this all took place on June 6.

I feel privileged to be the first president chosen from the ranks of those alumni/ae who hold only graduate degrees from the Institute. Listening to the T-Day remarks of President Charles Vest, as he described MIT's leading position in many engineering, science, and management programs, I also felt awed to be heading an organization dedicated to strengthening an institution whose record is already so impressive.

Fortunately, I have a road map to guide my task: Robert Muh, '59, the president for 1992-93, initiated the development of a long-range strategy for the Association. Under the leadership of Dick Jacobs, '56, my immediate predecessor, the Long-Range Strategy Committee completed the plan, and a number of its key recommendations were approved by the Association Board of Directors at the June meeting.

On my watch, the Association will be in transition from planning to implementation. Fortunately, putting new programs and plans in place fits my background working in complex organizations: since receiving my degree from Sloan 20 years ago, I have managed change and growth in computer service, laser manufacturing, and biotechnology companies. My recent projects have been more entrepreneurial—launching and financing new biomedical enterprises and managing early growth by implementing their business plans.



GETTING ON WITH BUSINESS

Dick Jacobs introduced the Association's new strategy to alumni/ae in his letter in the August/September issue of *Technology Review*, so I'll just summarize the key points:

■ Developing new communication avenues between the Association and alumni/ae, such as a computer bulletin board.

- Improving the process of soliciting, evaluating, and acting on alumni/ae ideas and suggestions.
- Improving staff response time to requests and questions.
- Moving the MIT Enterprise Forum to its next stage of development.
- Introducing specific fund-raising programs and continuing to improve the relationship between the Alumni/ae Fund and MIT Resource Development.
- Strengthening the revenue side of *Technology Review* and making it a more effective MIT news magazine for alumni/ae readers.

Implementing these recommendations will be a major challenge for the Association, which operates today in a context of limited financial resources, existing programs supported by vigorous advocacy groups, long-held traditions, a complex institutional environment, and a reliance on volunteer efforts. What we have going for us are a strong desire for change, an excellent staff, and dedicated and experienced volunteers.

HOW ARE WE DOING SO FAR?

The first two recommendations deal with communication and decision making. Cost-effective use of technology, such as a computer bulletin board, has the potential to address both concerns and will supplement the Association's 800 number, introduced in 1993.

But technology is only part of the answer; we also intend to make more effective use of existing resources, starting with the Association Board of Directors itself. The board includes elected representatives from the 11 U.S. geographic regions and various special constituencies. In the coming year, we will be emphasizing their role in soliciting input from club leaders and other involved alumni/ae, reporting regularly to board meetings, and rep-

President's Letter

News of the Muse continued

resenting the concerns of groups and individuals within their regions during board discussions.

Planning to address the third issue—staff response to alumni/ae requests and questions—has been underway for many months, and includes developing metrics to track requests that come in over the telephone or other media. The goal: to eliminate dropped or garbled messages and speed turnaround time.

The Association is in the process of hiring a new executive director for the Enterprise Forum. The Forum Board of Directors will be working with the new director to engage in their own long-range strategy process, with the objective of serving the entrepreneurial community while reducing the Forum's financial dependence on the Association.

The Association fund-raising staff has begun a close collaboration with Barbara Stowe, MIT's new vice-president for resource development, and her staff to improve the coordination between and overall effectiveness of the two organizations. Together, they are also developing new Alumni/ae Fund programs that focus on mid-range donors.

Technology Review continues to be an outstanding magazine for technology policy and is a popular benefit of membership in the Association. However, it requires a substantial annual contribution from the Association, and we are looking at both cost-cutting and revenue-generating measures. During the summer, the magazine hired a second advertising-sales representative and launched efforts to enhance revenue from the advertising network to which it belongs.

In his August/September letter, Dick Jacobs noted that only "implementation and results will tell" if the newly revised strategy is a good one. In coming issues of the *Review*, members of the Presidents' Commit-

tee (composed of the incumbent, the president-select, and the immediate past two presidents) will be reporting on our continued efforts and measures of success. We welcome your reactions. □

R. GARY SCHWEIKHARDT, SM '73,
*President, Association of Alumni
and Alumnae of MIT. The
Alumni/ae Association can be con-
tacted at 1 (800) MIT-1865 and at
<mitalum@mitvmc.mit.edu>.*

A TASTE OF BALI AT MIT

BY DEBRA CASH



Ever since Ziporyn remembers thinking at 5:30 that the performance that evening would attract 75 people—if he was lucky. Ziporyn, a composer and Class of 1958 Associate Professor of music at MIT, couldn't imagine that there were many Balinese gamelan enthusiasts in the Boston area. And how many people would have heard of Gamelan Sekar Jaya, the orchestra made up of a group of computer programmers, secretaries, carpenters, therapists, and teachers from San Francisco who were making their first East Coast tour after two successful visits to Indonesia?

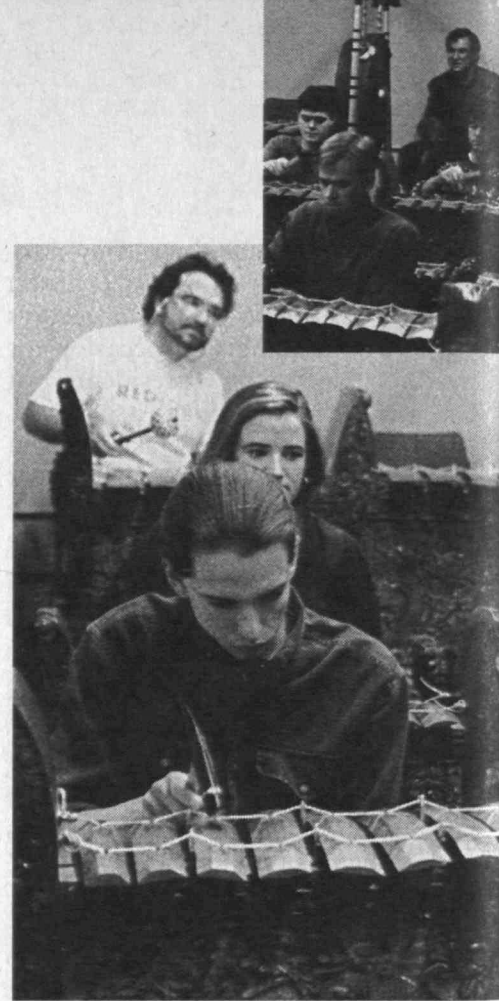
A gamelan is a small orchestra of mostly metallic percussion instruments. Gamelan music—rhythmically complex, technically demand-

ing, and based on a five-note scale—is the primary source of religious and concert music in Bali.

Ziporyn needn't have worried about his audience for the exotic art form. Despite a last-minute move indoors from the announced outdoor venue, the crush that greeted Sekar Jaya and MIT's own seven-month-old community gamelan, Gamelan Galak Tika, was more than 800 strong. It prompted a thrilled Maureen Costello, who is in charge of artist residencies at MIT, to declare "This is a happening!"

The performing arts of Bali came to MIT for three days of lecture/demonstrations, open rehearsals, and this public performance in April. Presenting both traditional dance and music, new works, and experimental pieces that blended Balinese and Western musical traditions, the events were, to appropriate the translation of Sekar Jaya's name, a "Flowering Success."

"In the Western musical tradition,





TWICE A WEEK FOR MUCH OF THE PAST YEAR, COMPOSER AND ASSOCIATE PROFESSOR OF MUSIC EVAN ZIPORYN (INSET) GATHERED THE STUDENTS, STAFF, AND OTHER MEMBERS OF MIT'S GAMELAN GALAK TIKA FOR A REHEARSAL OF THE COMPLEX MUSIC THAT CHARACTERIZES THE BALINESE ORCHESTRA. ZIPORYN, WHOSE OWN COMPOSITIONS ARE INFLUENCED BY THE MUSIC OF BALI, USED FUNDS FROM A WADE AWARD TO BUY THE SET OF TUNED PERCUSSION INSTRUMENTS, AND HE LOCATED TRAINED BALINESE MUSICIANS IN THE BOSTON AREA TO WORK WITH HIS FLEDGLING GROUP.

we're used to making distinctions between high art and 'fun art,'" Ziporyn says. "But what gamelan represents is a way in which you can combine a visceral kind of listening or experiencing of music or dance with something complex and intellectual. A lot of people are looking for that kind of artistic experience."

Galak Tika member Richard Stallman, '75, is one of those people. "There is no need for conflict

between people who wish to preserve their culture and others who wish to learn from it or adapt it," observes Stallman, who is widely known as a Free Software Foundation iconoclast. "Adaptation and fusion give us new forms of culture, while preservation prevents the loss of older ones," he believes. "Both contribute to cultural diversity and both are important."

Ziporyn, a clarinetist, was a member of Sekar Jaya for many years. He stresses that the exquisite complexity of the music, based on cyclic patterns of marimba-like metallaphones, gongs, and flutes, is only part of the story of Balinese music. The learning process itself is different than that in Western forms. Instead of learning from notation, the musicians learn their parts by rote, "from the ground up."

"It's a very difficult music; you have to learn it by ear and have to know how what you are doing is related to everyone else," Ziporyn explains. But this process builds "a kind of social web that extends out to other things, so that you're connecting with other people very directly."

Balinese musicians often study at the feet of a master, and both Sekar Jaya and Galak Tika have had the opportunity to work with superb Balinese artists. When Sekar Jaya appeared at MIT, their special guests included Balinese composer I Nyoman Windha, his wife, dancer I Gusti Agung Ayu Warsiki, and their accomplished sons—an 8-year-old dancer and a 6-year-old musician. The MIT students spent this past year working with masked clown I Nyoman Catra, and his wife, singer and dancer Desak Made Suarti Laksmi, who are based in Boston.

By the end of residency, Ziporyn marvels, Galak Tika was transformed. "They weren't playing like

the same group at all. They're a pretty amazing bunch, but just seeing Sekar Jaya work, seeing in the flesh what a good gamelan sounds like and how people relate to each other—their range of precision and dynamism—really made a difference. The other side was just seeing that they were ordinary people, musicians who screwed up just like we do. We were able to demystify that kind of process." And not surprisingly, after April's performances, Gamelan Galak Tika has attracted several new members. □

LETTER

MIT AND THE OVERLAP SUIT



AN APPRECIATION FROM AFAR

Editor's note: Louis Rosenblum, '42, brought to our attention a stirring letter to the editor in the May/June 1994 issue of Harvard magazine from Donald Kennedy, former president of Stanford. Kennedy was chiding the magazine for giving "inadequate credit to a splendid (and unusual) case of institutional stubbornness to yield on a matter of principle," in the case of MIT's battle with the Department of Justice over financial aid. We asked Dr. Kennedy if he would share some of his thoughts on the subject with the alumni/ae readers of Technology Review, which he generously agreed to do. The history of the "overlap suit" was the subject of an article in the April issue of MITnews.



The spring of 1991 was a troubling season for research universities in America: The Department of Justice was in full pursuit of MIT and the eight Ivy League universities, on the dubious theory that they had engaged in price-fixing in the award of scholarship funds (the "overlap case"); Rep. John Dingell (D-Mich.) and his House Subcommittee on Oversight and Investigations were holding hearings on indirect-cost recovery; and the National Institutes of Health—in the face of accusations of fraud against some universities and under pressure from the same subcommittee—had established an investigatory arm of their own and begun to assert new claims over research data.

Movement on all fronts has been rocky, with the most dramatic university success coming in the battle with the Department of Justice over financial aid—and entirely on the strength of MIT's efforts. Chuck Vest's decisions—first to challenge the federal department, and then to appeal following a disappointing result at the district level—were courageous ones. When the history of this period is written, it will be seen not only as a triumph for MIT and its leadership but as a landmark in university/government relations.

That view is not universal, at least not yet. A number of observers—including the editors of *Harvard* magazine, in a strangely dismissive treatment—have tended to discount the legal victory, pointing out that there will still be important limitations on what MIT and the Ivies can do by way of comparing awards to individual students. Although they may be right about the immediate limitations, the significance of the decision should be evaluated in a context much broader than the

issues actually presented by the case itself.

First, the appellate decision put an emphatic punctuation mark at the end of a truly outrageous exercise on the part of the United States government. As MIT and a phalanx of diverse supporters argued, there is reason to applaud, not to condemn, university efforts to stretch need-based financial aid as far as it can go. To treat the matter as though the agreements were a collusion to maximize profits was a gross misunderstanding of the issue—or worse.

But there are other reasons as well that reach to the core of the productive but difficult relationship between American universities and their government. The post-World War II decision to place publicly supported basic research in the universities was a momentous one for U.S. science, and surely a boon for the institutions in which it is done. As is perfectly natural, the patrons sometimes ask for a little too much in return for their patronage. At those times the bargain begins to look a little Faustian, and at just those times it is vitally important for the universities to push back.

For example, a stable assumption in the bargain between universities and the government has been the right of investigators to decide when and how to publish their own data from federally funded investigations; it is one of the keystones of academic freedom. Except for some restrictive attempts in the early 1980s by the Department of Defense—attempts that were forestalled by a coalition in which MIT and Stanford were leaders—that principle has been consistently supported.

Many readers of *Technology Review* will know that an issue of fraud has arisen in a recent multicenter breast-cancer study sponsored by the National Cancer Institute

(NCI). In April of this year, Congressman Dingell's subcommittee held hearings on the study, at which the agency's director made a profoundly disturbing promise (this quotation is from the hearing record): "NCI has clearly confirmed the principle that the granting agency can demand, distribute, and disclose a grantee's data in response to pressing public health needs." In other words, investigators have neither ownership nor control of data they

Alumni/ae Fund '94 *Over the Top*

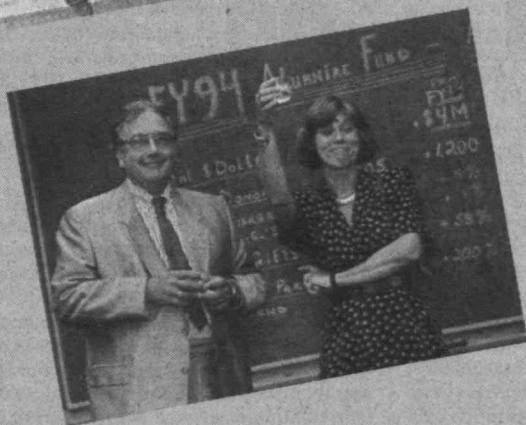
THE STAFFS OF THE ALUMNI/AE ASSOCIATION AND RESOURCE DEVELOPMENT HELD A PARTY IN JULY TO CELEBRATE THE SETTING OF A NEW DOLLAR RECORD IN THE 1993-94 ALUMNI/AE FUND. CONTRIBUTIONS OF \$23 MILLION FROM 28,205 ALUMNI AND ALUMNAE ECLIPSED THE OLD RECORD BY \$1.8 MILLION AND EXCEEDED THE 1992-93 FUND BY \$4 MILLION. FUND BOARD CHAIR NOEL BARTLETT, '60, REPORTED THAT HE WAS ESPECIALLY PLEASED BY THE 1,643 FIRST-TIME DONORS, WHICH IS THE LARGEST NUMBER OF FIRST-TIME CONTRIBUTORS REPORTED SINCE 1985. ALSO CAUSE FOR SATISFACTION WAS THE SUCCESS OF THE GRADUATE ALUMNI/AE PROGRAM (GAP), WHICH, FOR THE FOURTH YEAR RUNNING, RECORDED AN INCREASE IN DONORS AND DOLLARS FROM ALUMNI/AE WHOSE FIRST MIT DEGREE IS AT THE GRADUATE LEVEL. AND GIFTS TOTALING MORE THAN \$375,000 CAME IN FROM 445 NON-ALUMNI/AE PARENTS, EXCEEDING THEIR PRIOR GIFT RECORD BY 200 PERCENT.

generate in sponsored programs; a government representative may walk into the laboratory claiming a pressing public health need, walk out with the notebooks, and make the results public. Further description, I think, cannot make the prospect more chilling than it already is.

I mention this case not to argue that we are in for a totalitarian period in science. There will always be skirmishes along this front, and the universities will win our share.

But the price of freedom really is eternal vigilance. That is why it is so important that in the overlap case, one of the most celebrated tests of our institutional values, one university was stubborn enough to stand firm when the rest had left the field. At least to this observer, it was a cause for great celebration—not only because the good guys won, but because their victory has placed such a visible stake on frequently contested ground.

Chuck Vest, wonderfully supported by his predecessor Paul Gray and others, risked a lot in making the right decision. Constantine Simonides gave what sadly turned out to be the last months of his life to helping achieve the right outcome. I hope and believe that as our perspective lengthens, all of us in the academic community will recognize what a fine thing they have done on our behalf.—DONALD KENNEDY, PRESIDENT EMERITUS, STANFORD UNIVERSITY



UNFORTUNATELY, THE ALUMNI/AE FUND BOARD COULDN'T BE ON HAND FOR THE CELEBRATION OF THE FINAL TALLY, BUT THEY KNEW WHEN THEY MET IN JUNE THAT THE FUND WAS SURE TO HIT A RECORD BY THE END OF THE FISCAL YEAR. MIT'S NEW VICE-PRESIDENT FOR RESOURCE DEVELOPMENT, BARBARA STOWE, LED HER STAFF IN A TOAST TO THE FUND STAFF, FOR "THEIR CONTRIBUTIONS TO MAKING THE ALUMNI FUND THE BEST PART OF THIS YEAR'S FUND-

RAISING EFFORT." AND THE THREE GUYS SMILING FOR ALL THEY'RE WORTH—IN THIS CASE, \$23 MILLION—ARE (L. TO R.) ALUMNI/AE ASSOCIATION EXECUTIVE VICE-PRESIDENT WILLIAM HECHT, '61, MIT PRESIDENT CHARLES VEST, AND FUND DIRECTOR JOSEPH COLLINS. REMARKS FROM MANY OF THE FUNDRAISERS ON HAND PAID TRIBUTE TO THE REAL HEROES OF THE RECORD YEAR: THE THOUSANDS OF ALUMNI/AE, STUDENT, AND PARENT VOLUNTEERS.

ClassNotes

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Thanks to Frank H. Whelan, civil engineering, who makes his retirement home at Apt. 47, 1980 Commonwealth Ave., Brighton, MA 02135-5827, for thoughtfully sending us a widely

circulated, large newspaper aerial view of a campus patrol car parked atop the Great Dome of Building 10.

We await Frank's report on Technology Day to redeem his rating as 1921's top recordholder for attending the annual reunion luncheon.

As we prepare these notes, our daughter, Eleanor Clarke Blanton, and her husband, Joe, have just left Brielle to return to their retirement home on the Umpqua River in south-west coastal Oregon, after attending her 35th Simmons College reunion where she was elected president of her class. Joe continues to be very active in alumni affairs of his alma mater, Lynchburg (Va.) College.

Ellie may be remembered as our hostess for '21ers and their reunion guests under the tentage in the then Great Court for annual Alumni Day luncheons during her years at Simmons.

Thanks to **Sumner Hayward**, chemical engineering, for forwarding an unsigned picture postcard, mailed from New Haven, Conn., showing the Highpoint Motor Inn on one side and bearing a pasted newspaper clipping on the other. If the sender will write us, we'll be able to acknowledge appreciation.

The clipping, to our deep sorrow, reports the death of a highly respected electrical engineering coursemate, **Gustav O. Frederickson**, age 95, on May 14, 1994, in a nursing home in Granby, Conn., where Gus lived in retirement after working successfully for two Bristol, Conn., organizations—New Department Manufacturing Co. and Superior Electric Co.

A prolific inventor and equipment developer, he held many patents. He was a 70-year member of Stephen Terry Lodge 59, Independent Order of Odd Fellows, Bristol. He also was a Navy veteran of World War I. Gus prepared for MIT at Rindge Technical High School, Cambridge. At MIT, he was active in the Electrical Engineering Society and Technology Athletic Association. He was a native of Cambridge. Gus was predeceased by his wife, Louise McDuff Frederickson. He is survived by two sons, Roy B., of Beacon Falls, Conn., and Norman P., of San Jose, Calif., and three grandchildren. His niece, the Rev. Lois Rose, officiated at services in Granby.

On behalf of the MIT administration and his many friends of our student days, we extend heartfelt sympathy to Gus' family.

We need more letters. Where is yours? Mail it right away!—**Carole A. "Cac" Clarke**, presi-

dent and secretary, 608 Union Lane, Brielle, NJ 08730-1423, (908) 528-8881; **Samuel E. Lunden**, assistant secretary, 6205 Via Colonia, Rancho Palos Verdes, CA 90274, (310) 833-1480

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William A. Tripp wrote from Sarasota, Fla., last April, that he was sorry that **Martha Munzer** had to relinquish her duties as class secretary, but can understand the reasons why. He says, "Am still reasonably active, play duplicate bridge, and appreciate those annual birthday cards."



The story in the *Sun Sentinel* of Ft. Lauderdale, Fla., told of the nine women who were inducted into the Broward County Hall of Fame in commemoration of Women's History Month. **Martha Munzer** was included in this year's role models as we reported earlier, with the additional information about her receiving the Theodore Roosevelt Conservation Award in a ceremony at the White House in 1992. "My advice is to continue doing what you are doing. Just do it in moderation...and always keep laughing."

There are two deaths to report this issue. Colonel **Ray C. Burrus** died March 16, 1994. A resident of Boynton Beach, Fla., he was known as a watchdog of the Hallandale City Commission, according to the *Miami Herald*. As a retired engineer, Burrus had covered City Hall for the weekly *Hallandale Digest* since 1969. Burrus also served in World War I and

in 1942 he was recalled to duty to serve as chief of a Pentagon office that allocated aircraft and airfields for the European theater. He was discharged in 1947 as a full colonel. Later he made his mark in business, building a power plant that was sold to a Georgia power company. Then he worked for Florida Power and Light. He is survived by his wife of 72 years, **Jenette "Schotsy" Earl Burrus**—they had known each other since he was 5 and she was 3.

Allan H. Kidder died March 21, 1994. He was a resident of Haverford, Pa. After earning bachelor's and master's degrees at MIT, Kidder joined Peco Energy Co. (later known as Philadelphia Energy Co.) where he headed systems planning, testing and distribution. At his retirement in 1966, he was chief of research. In his community he was on the school board and planning committee and a former president of the Neighbor's Club. In 1984, he was given the borough's Helms Award for Exemplary Service. He was a former chairman of the Engineering Foundation of New York City and a fellow of the American Institute of Electrical Engineers, as well as a fellow of the AAAS, serving as the group's national director from 1953 to 1955. He is survived by his wife, Ester, a son, two daughters, nine grandchildren and ten great-grandchildren.—Class Notes Editor, *Technology Review*, MIT W59-200, Cambridge, MA 02139

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Two more of our classmates have passed on. **John C. Sargent** died February 18, 1994. He received his degree in electrical engineering. . .

Lockwood Oliver passed away March 30, 1994. He lived here in Vero Beach, Fla., in a beautiful home on the Indian River. He received his degree in general engineering. After graduation, he formed his own company. During the war he served in the Army Air Corps.

According to my records 62 of us are still living. Come on fellas, pick up that pen and send me some news of any kind before you join the choir silent.—**Royal Sterling**, secretary, 2350 Indian Creek Blvd., Apt. D-201, Vero Beach, FL 32966, (407) 562-3937

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Dick Shea sends an overview of the 70th Reunion in Cambridge: "We had rather a small representation, which, I suppose, is to be expected from a bunch of nonagenarians. Present were **John D. Fitch**, **Delbert W. Kendall**, **Stuart F. Morgan**, **Etienne** and **Eugene Wuirin**, yours truly and wife Louise,

and Katharine Hereford and guest Margaret M. Wishart.

"We had a very entertaining list of activities during our two-day stay at the Institute, starting with the sherry on Thursday afternoon, where we had delicious food and drinks, prior to attending the pre-Pops class dinner. Louise and I had arrived on Wednesday, were made welcome by the Class of 1934, and went to their class dinner that night, breakfast Saturday morning, and, best of all, on the boat trip up the Charles, seeing the impressive new Boston skyline, the river views of the MIT campus, the BU buildings and a bit of Harvard.

"Possibly the highlight of the whole reunion was our attendance at MIT Night at the Pops. (See full report in this section.) Friday was devoted mainly to a presentation of MIT's role in the arts, with talks by leading figures in the art world. The day ended with the class dinner including the classes of 1929 and 1939 and members of the Cardinal and Gray Society.

"At this dinner various classes reported on the extent of their class gifts to the MIT Alumni/ae Fund. Class of 1924 did itself proud, in my estimation, with gifts totaling \$3,899,821 during the most recent five years; 91 percent of the class participated, and 38 percent participated during fiscal 1994. A fine record, in my opinion!

"Well, here we are back home in Florida (whence, I must say, a majority of my classmates came from), tired but happy to have been able to attend. It was a fine affair, especially the privilege of seeing some of my old classmates once again. If any of you wish to elaborate on these notes, please be my guests!"

This report just about says it all and more accurately than I could have written. I do want to say that my friend and I took a tour of Boston and, although I have been to Boston several times, I learned more in that couple of hours than I ever thought I would know. I really enjoyed meeting Rock's classmates and being with them. My friend, Monie, and I look back fondly on our trip.—Co-secretaries: **Katty Hereford**, 237 Hacienda Carmel, Carmel, CA 93923; **Col. I. Henry Stern**, 2840 S. Ocean #514, Palm Beach, FL 33480

25 70th Reunion

Milt Salzman is one classmate who reports on his activities regularly. In mid-March he visited relatives in Dallas, Tex., on the way to attend the MIT Club of Mexico Fiesta in Mexico City and Puebla. This was Milt's fourth visit to Mexico. He shared accommodations with Wiley Corl, '39, with whom he roomed on his trip in 1980. He reports that the trips, events, sociabilities, and amenities of the host Mexican Club were superb and that they were gracious and considerate of the old timer grad. Milt hopes to make the 70th in 1995, suggests that we participate in the Cardinal and Gray Society's activities, and hopes we can make the 70th a memorable and gala event. He is still active with his singing groups. Your secretary suggests that classmates inform him as to where the 70th fits into their present plans.

It is with sadness that the passing of **Bruno E. Roetheli** must be reported. **Bruno** and **Sam Spiker** were fraternity brothers, Phi Beta

Epsilon, and Sam has supplied the information included here. **Bruno** died on December 26, 1993, at a nursing home in Wellsboro, Pa. He had suffered from Parkinson's for many years. He was one of the several Course X graduates who went with Esso, now Exxon, at Baton Rouge, and spent their working lives with that company. **Bruno** did spend time, 1927-33, at the Institute on the staff of the Chemical Engineering Department. He spent time at Bayonne, N.J., and for many years was stationed in England. **Bruno** took a leave of absence after World War II to serve as full colonel in the U.S. Army Air Force to study and report on the extent of industrial destruction inflicted by the allied forces with their bombing. After retirement **Bruno** took up oil painting and did quite well at it. He was a delightful and able man of few words and had a wonderful sense of humor. His wife, **Florence**, died in 1989 and there are no children.

Another classmate has passed on. **William E. Stone** died on June 12, 1994, at the Cape Cod Hospital in Hyannis, Mass. **Bill** had retired to West Dennis, Mass., 25 years ago. After graduation, he worked eight years with the Brown Paper Co. in New Hampshire and then worked for 30 years as a mechanical engineer and sales manager for the Rice Barton Corp. in Worcester, Mass. In retirement he worked part-time as a civil engineer on Cape Cod. His wife, **Yvonne R. (Dupre) Stone**, died a few years ago. His closest survivor is a daughter, **Sue L. Speckman**, of Westboro, Mass.—**F. Leroy Foster**, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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The old cliché "no news is good news" seems to apply to the Class of '26, for the only news I have this period is of the demise of more classmates.

Chenery Salmon of Newton, Pa., died April 29. He was raised in Turners Falls, Mass., and attended UMass/Amherst before coming to MIT. He served as a chemical engineer for Du Pont and later as a securities analyst for the First Boston Corp. and then the Merchants National Bank in Boston. In 1931 he married **Mary A. Cooper**. During World War II he served in the U.S. Army Chemical Warfare Service. After the war he returned to the Merchants National Bank and the family settled in Hingham, Mass. In 1956 he became VP and director of D.S. Kennedy & Co. of Cohasset, Mass., and in 1958 became a partner in Coffin and Burr, later a division of Advest Co. He served as a trustee of the Hingham Institution for Savings as a director of several industrial firms in eastern Massachusetts. He was a chartered financial analyst and a colonel in the U.S. Army Reserve, retired. He had served as class treasurer, and chair of several events. He and his wife moved to Pennsylvania in 1980. He is survived by two sons, five grandchildren, and one great-grandchild.

Shantanu L. Kirloskar of Poona, India, died April 24 at age 99. He had been chair of Kirloskar Brothers, Ltd. He earned his degree in mechanical engineering before starting to work in the family business, which had been making plows since 1904. Today, Kirloskar Brothers, the flagship company of the \$500 million Kirloskar group, is one of the top 10

ClassNotes

companies in India, operating 25 factories and employing more than 20,000 people. Under his leadership, Kirloskar Brothers diversified into manufacturing a range of engineering products, including diesel engines, electric motors, transformers, and pumps. His company no longer makes plows, but the name Kirloskar is synonymous in India with the diesel engine, the company's most popular product. He is survived by a daughter. His two sons and wife died earlier.

Please send news to **Donald S. Cunningham**, secretary, c/o Ronald F. Frazier, 132 Middle St., Braintree, MA 02184

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Arthur Connolly and your secretary represented our class on Alumni/ae Day. Art is one of the few, if any, classmates still actively working—as head of his big law firm in Wil-

mington, Del. He has several offices around the world and travels a lot dealing with patent infringement cases in foreign countries. I learned for the first time that my daughter, **Jane Burley**, was proper in being named Class Baby at our 25th Reunion in 1952. Art's son was born in March, and Jane in August 1951.

President Harold (Bud) Fisher usually attends our alumni luncheon, but skipped the occasion this year and sends best wishes to the class from his home in Duxbury, Mass. . . . **Gustavo Lobo, Jr.**, our class sugar magnate, sent news of moving from Florida to Hastings On Hudson, N.Y., for a chance at regaining his youth. "Now live in an 'arduous retirement community'—fine place overlooking Hudson, Zuider Zee, and Palisades. I am one of the enviable residents here: ratio is 15 ladies to 1 male—exciting!"

Clara F. Smyth of Falmouth, Mass., died December 19, 1993. She received a master's degree in public health at MIT, now referred to as biology/life science. We are sorry we have no story on her life's work. . . . **Thomas M. Stetson II** of Falmouth, Mass., died March 25. He was a post-grad architecture student in our class, having previously graduated from Harvard in 1924. He worked for several architecture firms in Boston and retired to Cape Cod.

Laurence T. Littlefield of Charlotte, N.C., died April 8. He joined Eastman Kodak Co. and lived in Rochester, N.Y., most of his life. He was an engineer in the Film Base Manufacturing Division and retired in 1969. He was a member of the MIT Club of Rochester, the Rochester Academy of Science, and the Gene-see Ornithology Society. His hobbies were golf, gardening, photography, traveling, woodworking, and bird carving. He is survived by his wife, **Ruth**, a daughter, grandson, and granddaughter.

Robert A. Engel of Southbury, Conn., died April 18. During World War II he worked as an engineer at Curtis Wright Propeller Division in Caldwell, N.J., and for the Chemical Warfare service in New York. His entire business career was spent in the aromatic chemical industry. He retired in 1968 as aromatic sales

director for Fritzsche Brothers Dodge and Olcott in New York City. He was an elder of the Presbyterian Church and former treasurer and chairman of the Council of United Church of Christ. Bob was a golfer ("hacker" at our 50th Reunion report) at the Heritage Village Golf Club, and his hobbies were carpentry and furniture refinishing. He is survived by his wife, Gretchen, a son, two daughters, and eight grandchildren.

We offer our condolences to the wives and families of these classmates.—**Joseph C. Burley**, secretary, Isle of Springs, ME 04549; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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While life in these "declining years" of most members of our class of '28 involves rest and reflection, **Paul "Bus" Ruch** is still actively engaged in long range weather forecasting research, an elusive quest that could keep him busy for many years to come, with his son Paul II doing the heavier work. Are there others who are defying the Laws of Diminishing Effort?

I have been pleased to relay to the appropriate MIT agency a bequest from **Louise Lester** in memory of her husband **Everard Mason Lester**, designated for Alzheimer Disease Research, an illness long suffered by Ev. Our thanks to Louise for her thoughtfulness. I will add my own appreciation of our long association and friendship with understanding, as my wife (also Louise) is now in a care facility with the same affliction.—**Ernest H. Knight**, secretary/president, Box 98, Raymond, ME 04071

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We have five deaths to report this time: **Philip A. Lamb**, Macon, Ga., on October 8, 1991; **Foster Gladwin**, South Weymouth, Mass., on March 10, 1994; **Lloyd T.**

Goldsmith, Sherman Oaks, Calif., on August 14, 1993; **Arthur L. Vieweger**, W. Long Branch, N. J., on March 26, 1992; and **Frank B. Stratton**, Lakeland, Fla., on April 12, 1994. There are no additional details for anyone except Frank Stratton, who was a retired pro-

fessor. He taught at Massachusetts State College and Grinnell College in Grinnell, Iowa. He was also chief research chemist for Maytag Co. for 11 years. Stratton leaves his wife, Myra, a son, and one grandchild.

Please send news about yourself or your classmates to **Karnig S. Dinjian**, secretary, P. O. Box 83, Arlington, MA 02174—ed.

30 65th Reunion

Those of you with long memories may recall that in the June 1972 issue I gave some of the details of **Reg Bisson's** distinguished career in World War II when he was on active duty with the Army Corps of Engineers. During this period he served overseas with the North African Military Mission. As commanding officer of the Levant Service Command he supervised the building of a general depot at the edge of the Sinai desert, including a 1,000-bed general hospital. In 1944 he was sent to the interior of China, where as district engineer he supervised the building of air bases for General Chennault's 14th Air Force and General Lemay's 20th Air Force. Recently he has been drawing on his WWII recollections to contribute information for a forthcoming book, *Runways for Tigers*, written by Colonel Jon Theus (Ret.) of Fredericksburg, Va., describing some of the problems and accomplishments of the engineers who built these airfields. Reg and his wife, Adrienne, still live in Laconia, N.H. They remain reasonably well and healthy, take leisurely rides in central New Hampshire, and enjoy being accused of spoiling their six grandchildren, who range in age from 4 to 29.

Lester Steffens still has numerous diverse interests. His small-sailboat racing, amateur theatrical acting, and volunteer work at an Audubon Ecology Camp in Wyoming have been previously reported. One of his latest projects is taking tennis lessons in an effort to refurbish the tennis game that he abandoned in 1936 and thereby improve his standing in a group of about twenty 65- to 85-year-old players of the Darien, Conn., Senior Men's Association. He is also working on a taped autobiography for the benefit of his daughters and grandchildren. Les is an avid devotee of Allen Gottlieb's "Puzzle Corner" to which he submits both problems and solutions. One of his bridge problems appeared in the April 1994 issue of the *Review*. Les lives near one of his daughters in Norwalk, Conn., and from time to time visits his other two daughters in Columbus, Ohio, and San Francisco. He continues to enjoy "better health than I deserve."

Yicka Herbert reports that he is still active in the management of his longtime business, the Franklin Paint Co., in which he has the help of his two younger sons. He

says the business is in "a very strong and profitable situation." He and **Maryann** play duplicate bridge every week, and as **Louise** and I can testify from personal experience, play very well indeed. In recent years they have been averaging two trips a year to foreign climes. **Yicka** says they are in excellent health, at least for their age, and are looking forward to the 65th Reunion next year.

A sad note from **Langley Isom's** wife, **Dorothy**, brings the news that he has Parkinson's disease, is totally blind and deaf, has a heart pacer, and is confined to a wheel chair. Dorothy took care of him at home for three years until it became necessary for him to go to the Mayflower Place nursing home, near Yarmouth Port, Mass.

We also have at hand a notice that **Leslie Engler** died at the University of Connecticut Health Center in Farmington last April 4. Les spent his entire working career at City College of New York. After obtaining an MS from MIT in civil engineering, he began teaching at CCNY in 1934 and became a full professor in 1950. In 1949 he was appointed dean of administration, a position he held until his retirement in 1973. An expert in soil mechanics, he designed and built the Soil Mechanics Laboratory at City College. During his years at CCNY he and his wife, **Doris**, lived in Tenafly, N.J., with their three children. Thereafter they adopted a two-home life style, spending summers in Quechee, Vt., and winters at the Oasis in Ft. Lauderdale, Fla. Les was always active in church and civic affairs, serving as president of the Community Chest and Holy Name Society in Tenafly as well as president of the Oasis board of directors. Les took up golf relatively late in life and became an avid devotee. After his retirement he and **Doris** both did volunteer hospital work, at Mary Hitchcock Hospital in Hanover in the summer and at Holy Cross Hospital in Lauderdale in the winter. In addition to **Doris**, Les is survived by a son, **John**, who is a clinical psychologist; a son, **Robert**, who is a city planner; a daughter, **Ellen**, who was at one time assistant to PBS President **Hartford Dunn**; and eight grandchildren.—**Gordon K. Lister**, secretary, Apt. 40, 5707 Williamsburg Landing Dr., Williamsburg, VA 23185

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Please send news for this column to: **Wyman P. Boynton**, secretary, 668 Middle St. Portsmouth, NH 03801

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Please send news for this column to: **Melvin Castleman**, secretary, 163 Beach Bluff Ave. Swampscott, MA 01907

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By this reading the 61st Reunion will be history. However, I have received notice that several classmates will not be joining us. . . . **Charles E. Fulkerson** writes that he will be attending the annual Fulkerson family reunion in Galt, Mo., on May 30, which just



Class of '29 Secretary Karnig Dinjian and his wife, Helen, at the Technology Day luncheon.

precedes our get-together. Moreover, his wife, Elizabeth, passed away on January 26 after being hospitalized since last August with Lou Gehrig's disease. The Fulkersons were married in 1936. They have four children, including Heidi, who was a delight at our 60th renowned Reunion. In the 25th *Reunion Classbook*, Charles says that his family is his biggest interest. The 61st Reunion will of course miss the Fulkersons. Please note that Charles' new address is 215 Applewood, Southbury, CT 06488.

John F. Longley and his wife Lillian will miss the 61st Reunion as well. John has written to Dick Fossett, Bill Huston, and me in one all-inclusive letter. He is amazed that his 5-year-old granddaughter plays rings around him on Lillian's super-duper computer. In an aside for Dick Fossett, he writes, "15-meter amateur radio has just about gone dead. . . I still have my weekly 'sked,' anywhere from 3 to 10, with friends that I was with overseas in '41 and '42. It is on or near 14,270 at 1,600 GMT on Friday mornings." John invites Dick to join the "net," although he says summer radio propagation situations will be quite erratic what with QRM and QSB not helping at all. Along with Bill, he excuses himself for not making the 61st Reunion. John further reports that he has no pains, is content being a homebody in his home of 43 years and takes great pride in wife Lillian's art career, particularly her landscape and garden paintings.

Leonard Julian, our East Coast VP, gathers a lot of news, but very often each bit of information leads me to stories that I could expand on indefinitely. One of these is the *Boston Globe* obituary of Benjamin F. Olken, who passed away April 2 in Sarasota, Fla. Ben did not finish at MIT nor in an architectural career, but he was probably one of the most successful entrepreneurs who began with us. Harvard University annually presents an award for entrepreneurial spirit in Ben Olken's name and that of his late twin brother, Henry. I knew Ben before and after MIT, and know that whatever Ben undertook he did so modestly and graciously. . . . Len also informs me that Margaret B. (Kelly) Geddes's new address is Hallworth House, 66 Benefit St., Providence, RI 02904. This came to him by way of Margaret's niece, Leila Kelly De Rosa. Margaret is one of 22 Course IV bachelors and bachelorettes in architecture of our class. Coming to MIT with a previous AB, she was always looked up to as the most understanding of all the prodigal neophytes of the group. We loved her then and now. Do write her, please!

James R. Merrill passed away January 26. Although not much has been recorded about him, James's wife, Margaret, has filled in the blanks quite interestingly. Early on, James and Margaret grew up in Jacksonville, Ill., and completed high school there before they went separate ways. James attended Illinois College in Jacksonville for two years before transferring to MIT and Course VI, electrical engineering, in 1930. Meanwhile, Margaret went on to the School of Library Science at Columbia University, where she joined the staff after graduation. James visited Margaret in New York City after graduation with our class, and they have been together ever since. James began work there with Consolidated Edison. World War II brought them to Massachusetts and Raytheon Corp., with whom he stayed until retirement in 1975. The Merrills

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settled in Santa Barbara, Calif., where James was Raytheon's plant manager. I believe James was a fraternity brother of Alpha Tau Omega at MIT and had many friends there.

Many little-known tidbits came out of the 61st Reunion that may bring a smile to your face. Seems as though Mal Mayer and I may have attended Braves Field in Boston to brave it through Braves games as Knot Hole Gang kids—for free. In the early '20s, we kids were about the only optimistic fans at those sparsely attended games. . . . Wilber Huston and wife Dorothy also have a love for baseball: they watch the lamentable Chicago Cubs on the superstation WGN out of Chicago, as well as the Atlanta Braves. . . . Ed Simpson was surprised to see some faded pictures of the fourth-year architectural football team beating the fifth-year architects 12 to 6. Tackle football without any protective gear seems unthinkable now. The fourth-year line was John Mihnos, Berj Tashjian, Gordon Bunshaft, Whelan, Bill Brown, Don MacCornack, and Tom Fitzpatrick. Seems we had a non-roster (ringer) backfield player, since Ed Simpson, Ham Brown, and Joe Carbonell are identifiable. Cheering for the fourth-year team were Margaret Kelly, Hazel Weld, and Dolan, who saw the upset of the heavily favored fifth-year team, even with Harry Wiese in their backfield.

On another note, it was very gratifying, as well as disconcerting, to attend the Annual Memorial Services in the Kresge Chapel on Technology Day in remembrance of MIT alumni/ae listed as deceased between March 27, 1993, and March 25, 1994. Of the 20 names listed for the Class of 1933, I have no record of the death dates of Fred A. Bickford, Francisco M. Camp-Campins, and Samuel

Lieben, all post graduates. One name inadvertently omitted in the listing was our beloved Ernesto De Sola who passed away September 10, 1993.

Other events of Technology Day can be read elsewhere in the issue. Pops Night was extremely gratifying, with John Williams comparing his extraordinary drummer Fred Buda to Louis Prima, Gene Krupa, and the like before the playing of "Sing, Sing, Sing." Overlooking Buda from balcony seat A-1 was like having a command performance all to myself. The playing of other numbers of the fab forties was equal to MIT's David Deveau playing the wonderful second movement of the Ravel Concerto in G for piano and orchestra. A great, great night from a great, great seat.

Saturday, June 4, I spent with our very retired, scholarly bookworm Mark A. Kalustian and his sister, Alice, whom I have known since my Boston days. His collection of rare books matches any private collection. He is busily preparing the collection for public auction. One of his books bears the note, "To Mary A. Lincoln from her Loving Husband" in Abraham Lincoln's handwriting. Interesting that his wife was Mary A. as well as the more common Mary T. Mark has a valid explanation for this.

To close, the passing of Paul M. Gerhard on May 30, 1985, has just been reported by his wife, Florence, who leaves no present address. . . . Thomas Francis Twomey passed away March 25, as confirmed in the *Buffalo News* clipping of March 27. More on the biographies of these two classmates in the next issue.—Berj Tashjian, secretary, 1245 Briarwood Lane, Northbrook, IL 60062, (708) 272-8683

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My June *Technology Review* arrived, and it was good to see news of The Great Class of 1934 back in its columns again. . . . Our secretary, Bob Franklin, died about a year ago, and George Bull, assistant secretary, died March 17. George, Course XV, died of pneumonia after being hospitalized for a pedestrian accident in front of his home. His wife, Mary, died in 1986. He is survived by a daughter and two grandchildren. He was a retired colonel and CIA analyst of scientific data for the past 27 years. He worked for Merck and Socony Vacuum Oil before entering military service in World War II.

There has been no class news until recently, when Nancie Barber of the Alumni/ae Association took over. We would like to express our thanks to her. Unfortunately, many of the notes you sent in have been lost in the hiatus.

At the 60th Reunion, Carl Wilson was elected secretary. The primary job of the secretary is to be a conduit of news from you to the columns of the *Review*. So write often with any news of yourself, your family, and/or any of our classmates. We are planning a series covering the careers of class members, so start thinking about yours.

Our reunion attracted about 75 class members, wives, and widows. The weather was perfect; everyone declared it the best reunion ever, primarily due to the efficient organization of the Alumni/ae Association and its coordinator for the Over 50-Year Reunion Classes, Jane Snyder. More than 40 attended the Songfest Dinner on Wednesday night. After a delicious pepper-steak dinner, we sang about 50 songs, accompanied by a professional accordionist. Paul Wing accompanied him on his recorder adding much to the music and festivities. Ernie Massa soloed "O Sole Mio" and "Arriverderci Roma." Ernie and wife Jeanette were celebrating their 54th wedding anniversary, and Max Winer and wife Thelma, their 50th. Dick Shea, class president of 1924, and his wife, Louise, were dining alone, so our class adopted them.

Thursday morning, 46 of us took buses to the Museum of Science for a leisurely cruise on the Charles, followed by a buffet luncheon. Dick and Louise came with us. After lunch we wandered through the museum, followed by an Omni presentation of "Search for the Great Sharks." We joined with all alumni for the pre-Pops buffet and the Pops concert, with John Williams conducting. Fellow alumnus and chair of the MIT Corporation, Paul E. Gray, '54, led the orchestra in a spirited rendition of "Stars and Strips Forever."

At lunch on Friday our class presented the Institute with \$2,145,000 as the cumulative giving for the past five years. A fantastic job of which we should all be proud. At the Faculty Club, the group size swelled to 64 for dinner and a class meeting. President John Hrones remarked that he was "having a wonderful time getting to talk with each of you . . . and that I suspect our legs, ears, and bottoms are getting tired!" That brought knowing laughter. When Roger Williams, chair of the Nominating Committee, presented the slate, and after John Hrones was reelected president, someone in the class remarked that there was only one way that John could *not* be reelected. Other officers chosen were Russell Hastings, first vice-president; Edward Asch, second vice-

president; Larry Stein, treasurer; and Carl Wilson, secretary. Larry presented his treasurer's report. A motion was passed that any funds left in the class treasury be bequeathed to MIT after the death of the last class member or in 2015, whichever came first. Hank Backenstoss was thanked for a great job on the 60th Reunion Gift. Carl Wilson received plaudits for his committee's work on the reunion, as well as Al D'Arcey for converting a combination of 8 and 16mm movies taken over the past 55 years of reunions into one six-hour VCR tape. The possibility of reproducing these and making them available to class members is being investigated. More on this later.

A moment of silence was observed for deceased classmates and spouses. Walter McKay brought us up-to-date on our classmate in China, Wing Lem Wu, who stopped writing about three years ago. Relatives in the USA have contacted Walt to report that Wing's wife had told them that he had suffered a stroke and is recovering slowly.

On Saturday morning, 26 left on a bus tour called "Boston—Made in Cambridge by MIT." We saw over 30 buildings and construction projects in downtown Boston that were designed, developed, or in the process of being renovated by MIT alumni, including Edmund Wheelwright (1875), George Shipley (1882), I.M. Pei ('40), George Manomber ('48), and Norman Leventhal ('38). At noon, we had a great "Techsas" barbecue, followed by music, fun, and games in the afternoon. Thirty-two attended cocktails and dinner at the MIT Museum. Sipping cocktails, we wandered around viewing all the MIT memorabilia, a fascinating holograph display, the best in the country. An extra treat was provided by Museum Director Warren Seamans, who led us into the bowels of the museum to see the campus police car, complete with flashing lights and an inflatable "policewoman" eating doughnuts and drinking coffee, that had been placed atop the Great Dome during the night of May 9 by a group of MIT undergraduates. Annette Asch, newest member of the '34 family, immediately dubbed the policewoman "MITsi." We have officially submitted that name to the museum. A telegram from Burt O. Summers was read at dinner. On Sunday morning we parted company after a delicious lunch at Stratton.

Fred Barrett III writes that he suffered a mild stroke in June 1993. Having an occupational and a physical therapist in the family has led to a complete recovery. Fred planned on attending the reunion, but a granddaughter's high school graduation in Boulder, Colo., prevented it. . . . Wally Wise writes that he and Alice had to be in Luxembourg, where his daughter lives, from June 1 to 6. . . . John D'Albora, Jr., also wrote that an emergency prevented his attendance. . . . Anita and Al Rogowski wrote from Smithfield, R.I., to express their regrets at not attending. They felt that they were just not mobile enough. . . . Jean Esslinger wrote with the sad news that Art Esslinger passed away September 28, 1993. Art spent most of his working career as an account executive and VP at McCann-Erickson, a major advertising agency, where he handled national accounts. He was a retired lieutenant colonel in the Air Force. Besides his wife, he is survived by three children and three grandchildren.

Mary Burke, widow of Jim Burke, wrote that she would be unable to attend the reunion because of a commitment she made to attend a reunion of people who lived in India during the 10-year hitch that she and Jim served there. They also spent three years in China. Jim was the owners' representative for the Isthmian Shipping Co. . . . Max Winer writes that he is CEO of Research, Inc. in Newtonville, Mass., consulting in the environmental field including the incineration of polluted soils at national priority sites, as well as Massachusetts DEP sites. . . . Hal Thayer, former CEO and board chair of Mallinckrodt, Inc. in St. Louis, writes that after 43 years there he retired in 1982. He now spends three to four months in Ocean Ridge, Fla., and claims to be the poorest golfer in Florida and Missouri. Anyone who resides in those two states can issue a challenge for that title. . . . Rita Skinner, widow of John Skinner, writes that he died in 1967. He was a pioneer in the field of industrial hygiene, wrote extensively about it, and was a national authority and speaker on the subject. He also worked for a large insurance company, where he oversaw health conditions in factories they insured. There are three children.

Dave Robbins writes that after retiring from Raytheon, he became heavily involved with two major construction projects. One in South Chicago involved toxic-waste recovery and disposal, and another in Akron, Ohio, recycling an energy system. He is currently busy with his photography, investments, three children, five grandchildren, and three great-grandchildren. Can anyone top that record?

. . . Stanley Knight tells us that after graduation he got an SM degree and received his first job in 1935 through the MIT Job Placement Office. He worked in New Bedford, Mass., at Continental Screw Co. as a metallurgical engineer. No military service—industrial deferment. Now no deferment from heart and prostate problems. Otherwise a happy and pleasant 1994 to one and all! . . . George Cunha tells us that since retiring from the Navy in 1963, he has been active as a conservation consultant for library and archival materials and works of art and paper. He is currently adjunct professor of conservation at the University of Kentucky's College of Library and Information Science.

Bob Becker's wife, Sylvia, tells us that she is on the staff of Art New England as primary proofreader for editorial production. She dabbles in watercolors, writes, and is a study group leader of an art group for the Brandeis National Women's Committee. She has six grandchildren and one great-grandchild. . . . Frank Moore writes that he just returned from another trip to South America, which he feels will probably be his last. He saw several of the 2-6-6-2 Mallets, whose boilers he designed. Frank has had a full and active life working for the Baldwin Locomotive Works in various aspects of railroad and locomotive design. When Frank was an undergraduate at MIT, his fascination with railroads earned him the affectionate nickname, Choo-Choo. . . . Ellie Kron, widow of our class agent and beloved Phil Kron, called to ask me to say hello to all her MIT friends at the reunion.

ClassNotes

Graydon Abbott passed away in San Jose, Calif., on January 14 after a short illness. Graydon graduated in Course XIII-C, ocean engineering. He spent nearly 30 years with the U.S. Navy Department in the design branches of the Quincy, Mass., and Long Beach, Calif., Naval Shipyards. He owned and operated commercial vessels as a young man and enjoyed recreational cruising for most of his life. He is survived by his wife of 55 years, Dorothy, his son and daughter-in-law, and three grandchildren. . . . Ted Lucas sent a note telling us that he has written four articles for *Avionics Magazine*. He is also contributing editor for *Flat Panel Display News* and sales manager for West/Midwest for *Information Display Magazine*. He has written three books on solar energy and one on electric cars. (Where were you, Ted, when we were looking for a class secretary?) His wife, Joan, designed their ocean-front house on the Oregon coast. He sends greetings to all, and to Jim Eder in particular.

This concludes my first set of Class Notes. The *Review* is published eight times a year, and I am depending on you all to provide me the material! Have a good autumn! I started to say "fall," but changed for fear someone might take me literally!—Carl H. Wilson, secretary, 48 Druid Hill Rd., Newton Highlands, MA 02161

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35 60th Reunion

Herbert G. Anderton, Jr.,
provides the first letter for
this issue from his home in

Cotuit, Mass. "I have resisted the urge to write you up to now and have finally convinced myself that someone, somewhere might wonder about whatever became of what's-his-name." Well, lean back and I'll tell you. Herb went to work for Liberty Mutual Insurance Co. in 1933 in their mail department. When he retired 46 years later, he was VP and manager of reinsurance and foreign insurance. He served on the board of directors of the Foreign Credit Insurance Association from 1967 to 1979 and as its chair from 1972 to 1975. That organization was set up at President Kennedy's request to write foreign commercial credit insurance in partnership with the Export-Import Bank in the United States. Herb was a member of the executive committee and chair for two years of the Excess and Casualty Reinsurance Association. He initiated the formation of two wholly owned subsidiaries in London, Helsman Ltd. and Liberty Mutual Insurance Ltd., and was responsible for their operations from 1965 to 1979. Herb and wife Jean celebrated over 55 years of marriage, have two children, four grandchildren, and one great-grandchild who was due in September. Herb and Jean lived in Needham, Mass., until they moved to Cotuit, Mass., in 1980. Herb was a member of the board of directors of the Needham YMCA for 15 years and president for one. He was also chair of the board of trustees of the Y and deacon of the Congregational Church of Needham. Currently he is on the executive committee of the Santuit Civic Association in Cotuit. They journeyed to Siesta Key in Sarasota, Fla., for a few months each year until last July, when Herb had a mild stroke that left him with some residual effects such as not being able to taste anything. Jean has made some recovery from cancer but "still has a long way to go." In spite of everything, they are managing quite well with the help of their children and some wonderful neighbors and friends. He would enjoy hearing from his Course XV friends at 23 Brandywine Court, Cotuit, MA 02635.

Richard F. Jarrell writes from his home in Waban, Mass., that he is still consulting for Thermo Jarrell-Ash in Franklin, Mass. He attended the 1994 Pittsburgh Conference, "the oldest surviving original exhibitor with a Hilger Large Littrow Quartz & Glass. Spectrograph, Hilger, England is now also a part of Thermoelectron."

We have just been informed of the death of William A. Leary on December 10, 1988. . . I regret telling you of the death of two more '35ers: Henry F. King on January 13, and Henry J. Ogorzaly on May 21. Henry King lived in Chatham, Mass. He moved there in 1976 after his retirement from Mobil Oil Corp., where he had worked for 34 years and retired as district manager for New England. He was a member of our class golf tournaments of Eastward Ho Golf Club. He is survived by his wife, Elsie, three children, and at least four grandchildren. . . Henry Ogorzaly lived in Summit, N.J., for 46 years. He served in various positions with Exxon Corp. for 32 years and held 53 U.S. patents for which he received

many awards. He is survived by his wife of 50 years, Jewel, two sons, five daughters, a brother, and thirteen grandchildren. I am sending our condolences to both Henrys' survivors.—Allan Q. Mowatt, secretary, 715 N. Broadway, #257, Escondido, CA 92025

36

About 1960, Alice Kimball may have been a catalyst in creating McCormick Hall, the first women's lodging on campus (and headquarters for our 50th and 55th Reunions). The

scene was a Cambridge meeting of alumnae to discuss co-ed matters. Lodging was and had always been a major limiting factor in numbers of female applicants and their geographical spread. Alice commuted from home in West Roxbury, Mass., during 1932-36. At the meeting she told of her daughter Prudence's going to Brown because her father insisted that she have the benefit of campus living not available at MIT. We lost an excellent student who went on to do graduate work at the University of Washington. Pru is now chair of the Science Department at Crawfordsville High School in Indiana.

Alice's account, reinforced by others, was heard by Katharine Dexter McCormick, '04, who was sitting in the back of the room. Very soon after, she offered a dormitory on condition that it be *on campus*, and the first wing was dedicated in 1963. Now, in 1994, the May-June Class Notes section of *Tech Review* included an announcement of founding the Katherine Dexter McCormick Society to honor the donor, who also left her entire International Harvester fortune to the Institute. My wife, Phoebe, remembers a 55th Reunion conversation about the hall with Alice, but her personal connection was news to me, and she pooh-poohs any credit.

To finish the highlights of Aldo Bagnulo's letter (May-June issue): After 29 years in the military, he did private practice, mostly in sanitary engineering, and his MIT degrees in Courses I and XI "seemed to open doors to several projects. The most exciting was managing an economic feasibility study in New South Wales, Australia, of upgrading an existing coal-mining operation and building a 40-mile railroad with coastal docking and bulk-loading facilities. My conclusion was 'not feasible,' and I had studied myself out of all the construction management that would have followed." On the telephone recently, Al's voice was much improved from therapy after a troubling bout with laryngitis and the danger of something more serious. He and wife Helen chuckled over part of the diagnosis: "a bent vocal chord."

Grace and George Crummey celebrated their 55th anniversary on May 6, and her note tells of a weekend family party in Charlotte, N.C., with their daughter, four sons, and ten grandchildren all attending. George has suffered spinal stenosis for two years, but an operation has given partial relief. "I can live with it, walking with a cane and exercising in a walking pool." He sounds very upbeat.

In March, Doris and Towers Doggett stopped and spent a night—first in a long time—on their way home from Edisto Island. . . The National Council of Acoustical Consultants recently honored Oliver Angevine (Course VI-C) as one of its founding fathers

and an officer and/or director ever since. After 15 years with Stromberg Carlson (chief engineer of Sound Systems Division) and 10 as VP of Caledonia Electronics, he joined an acoustical consulting firm that became his own. The NCAC newsletter praises his pioneering developments, including dynamic cancellation of transformer noise and measurement of machines' sound power output. He credits his success in acoustical design for hundreds of auditoria and churches as beginning with physics Professor Philip Morse. It also seems to mesh with a long-time interest in philosophy and the arts, beginning with his parents reading him Greek myths and tales of ancient Rome. Art or science, Ollie's career in acoustics has been a good measure of both. He will retire this year at 80, and John Earshen, '50, is taking over.

Page MIT 7 of the January issue pictured eight alumni/ae, representing groups receiving Presidential Citations for distinguished service. **Bill Rousseau** has long been a prime mover of Chemical Engineering Practice School and its Class of 1936, corresponding with 40 or more members annually since graduation. This group alone produced an endowment for annual fellowships in the school—a first. The citation spoke of “dedicated volunteers maintaining close ties with each other and MIT.”

Cheers for the life of **Randal Robertson**, who died November 21, 1993. Randal was with us four years for a PhD in physics, after graduating from the University of Glasgow where his father was posted in the U.S. Public Health Service. During World War II Randall

worked on airborne radar systems in our Radiation Laboratory, and postwar in the Office of Naval Research, Washington. In 1958 he joined the National Science Foundation as assistant director for mathematics, physics, and engineering, and by 1967 was associate director of research, where he gave early recognition to the importance of radio astronomy. From 1970 to retirement in 1976, he was dean of Research Division at Virginia Polytechnic Institute and helped develop its program in astronomy. Our thanks to his widow, Florence, for much of this information. Randal's grandson, Andrew D. Robertson, is Class of '93, Course XVI. . . . And a toast to the life of **Paul Richardson**, Course II. A *Hartford Courant* clipping, mailed anonymously to **Pat Patterson**, tells of his death March 27 in Portland, Maine. His career was in engineering management with Paragon Gear in Taunton, Mass.; the famed Jacobs Chuck Co. in West Hartford, Conn.; and Product Machine Co. in Bridgeport, Conn. The notice said that Paul “served on municipal zoning boards, was an historian of New England architecture, and enjoyed sailing,” which brings to mind October 1989 Notes of a conversation with wife Virginia (deceased May 1993). She recalled fun at Phi Delta Theta house dances, but gave up the '36 Senior Class Tea Dance to “shuck off hat and heels” and sail a Tech dinghy with Paul on the Charles.—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

ClassNotes

37

By now the 1994 class reunions are history. Our class attendance at the Technology Day luncheon, however, sitting at the Cardinal and Gray Table, hit a new low. Only

Mel Prohl, Roger Wingate, Hobby Hobson, and Len Seder clapped through all the updating and class gifts. (Of course, this does not include those who may have attended other Day activities.) Mel and Roger reported that they are enjoying their retirement. Hobby told us how he had formed the ABANAKI Corp., run by two of his sons, which develops oil skimming and is located in Rye, N.H., and Chagrin, Ohio. Hobby also mumbled something about having 14 grandchildren. We can't help observing that he is well ahead in the Production Division. (Or is he? Let's hear from some of the rest of you.) Len Seder, your assistant secretary, reported he has reduced his consulting activities on quality management now that there is a plethora of consultants all over the world to help companies design and adopt the mandatory systems that permit them to do business with one another. Len is considering a real estate career next.

Missing with good reason was our class secretary, **Bob Thorson**. His wife, Rose, had patiently waited while he recovered from his bypass, and then it was her turn: she had two

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knees operated on the day before Tech Day. Bob reported that she was home the next day and is doing very well. . . . In the mail came some interesting and newsy bits. Fred Altman retired as senior scientist of the Cyber Co. in 1991. Since then, it looks like he has been having a ball traveling about the world. In 1993, he was in Guatemala and took Spanish classes, next in France (can't make out doing what), then back in the U.S. doing the Northwest Parks, including Banff, then to Turkey and Cappadocia. Took off a couple of months to be sick and then into 1994 with a cruise and visit to Puerto Rico; finally the Fjords. When he isn't roaming the world, he does hiking or square dancing. What's next, Fred?

Then there is Richard Ewert, who received both an SB and SM in '38 and who will be remembered by many '37ers with whom he took some classes. His career was largely in gear theory and manufacture. He retired in 1988 as president of the Sewall Gear Manufacturing Co. in St. Paul, Minn. He then became a consultant and wrote the chapter on gears for *Mechanical Power Transmission Components*, a handbook edited by David South and Jon Mancuso and published by Marcel Dekker to be in stores shortly. But he didn't stop there. In the composing room of McGraw-Hill is a book co-authored by "Huck" (now do you remember him?) and Dave South called *Encyclopedic Dictionary of Gears and Gearing*, due to be published by the end of the year. Finally, for now at least, he has a draft at Marcel Dekker for a book of his own, to be titled *Gears and Gear Manufacture, Fundamentals and Applications*, due out next year.

Carl Sontheimer didn't have time to write, but he let us have a peek at an issue of *Dialog*, which tells his story. The following is a direct quote. "Since the Cuisinart food processor was first introduced into the United States in 1973, it has been a pulverizing success. [Ed: now I see why puns are so frowned upon.] With a flick of its switch, difficult pâtés, sorbets, soups, purées, and sauces are suddenly easy. Moreover, it revolutionized the electrical home appliance industry. The Cuisinarts Corp. was founded by Carl Sontheimer, a retired, MIT-trained physicist and dedicated cook, who was touring in France in 1971 making plans to start a part-time import business of high-quality stainless steel cookware. Instead, he became fascinated with a professional restaurant and food-preparation device invented by Pierre Verdun. Verdun had planned a home version of the machine, and Sontheimer persuaded him to start distribution in the United States as well as Europe. The physicist also made several safety and design adaptations to conform to American Standards."

Ernie Ferris, after spending 44 years in Chicagoland, and his wife are giving serious thought to moving to Portland, Ore., to be near "my eldest son and his very appealing 3- and 5-year-old daughters." He, too, was concerned that we get the full story on the following item. . . . Since our brief report on the death of Michael Zinchuk back in April, we have received more information. He had gone from Tech to Harvard and received a master's degree in communications in 1939. In World War II, he served at Wright Field in Dayton. His wife wrote us a very sad letter, telling how he took care of her after she suffered a frac-

tured leg following a successful hip replacement. Just when she was able to walk with a cane, Michael came down with scoliosis, a recurrence of a form of polio he had as a child. He died of respiratory failure in March. We want to express our sorrow to the Zinchuk family.—Robert H. Thorson, secretary, 66 Swan Rd., Winchester, MA 01890; Leonard A. Seder, assistant secretary, 1010 Waltham St., #342B, Lexington, MA 02173

38

Our successful mini-reunion June 3-4 (capping the MIT Alumni/ae Week) brought 18 class members and 16 guests to MIT's Endicott House!

Two classmates and two guests attended only the Cambridge festivities. (There was a basic conflict with the concurrent Wellesley Alumnae celebrations; decisions were being made by a 1-1 vote.)

In Cambridge, it was a great pleasure to welcome Ina Gordon, who came to the Technology Day luncheon with some of Haskell's friends! (Haskell Gordon, deceased September 17, 1991, was remembered in a brief obituary in the 1992 Class Notes.) . . . Sol Kaufman had an impressive conflict during Alumni/ae Week, reporting, "I am getting an honorary doctorate on June 5 from Hebrew College in Boston!" Sol has been chair of the trustees of Hebrew College, a member of the governing council of the American Association in Jewish Education, and a member of several executive boards. This year in May, Sol and Sylvia visited their son and his family in Israel: "He has twin daughters aged 20 months. Sylvia and I had a great time playing with them." Thus continuing Sol's emphasis upon quality education!

Don Weir and Betts, with Al Wilson and Carol, were also with us in Cambridge for the Technology luncheon, and then departed for Wellesley. . . . After we left Cambridge for Endicott House, but before the reception began on the terrace, several "actives" met at Fred Kolb's suggestion to discuss two questions affecting the class: (1) Should the annual mini-reunions continue, and how can we manage them with declining attendance? and (2) What should be the format of our "rapidly approaching" 60th Reunion? If you have recommendations and preferences, please draft and send them on to Fred before the holiday season swallows your cognitive and disposable time.

As the full group assembled and the camaraderie leaped back undiminished, the resounding recommendation from the 1994 mini-reunion was, "Continue the minis as long as possible!" . . . Classmates at the Endicott House included Norm Bedford, Lou Bruneau, Lloyd Bergeson, Bob Campbell, Paul Des Jardins, John Glacken, Frank Gardner, Ed Hadley, Roy Hoppgood, Lew Hull, Sol Kaufman, Frank Kemp, Fred Kolb, Dave Morse, Paul O'Connell, Gus Rossano, Don Severance, and Dave Wadleigh.

Discussion on the terrace drew an interesting connection between the Class of 1938 and Robert College in Istanbul, Turkey (now associated with the University of Istanbul). Frank Gardner and "E" were going to Turkey in August. "E" Barnum's parents were on the Robert faculty, and she was born in Turkey—coming to the U.S. to attend college. Dick

Muth taught at Robert College in 1940, as Tech-in-Turkey representative of TCA. He met "E's" family, and when she came to the U.S. he introduced her to Frank! (Dick remains well known at Robert College, because when he first arrived by ship at Istanbul, he rode down the gang plank on his motorcycle!)

Then we heard on the terrace that Ed Hadley's son Peter, '72, had taught for two years at Robert College in a UCC exchange. Ed and Jean had traveled there on a UCC guided tour to visit him and to meet the U.S. group on the faculty! . . . And next we found that Dave Wadleigh's grandfather had been head master of Robert College!

Also heard on the terrace: Al Wilson and Carol were leaving in late June for an Elder-hostel Folk Colleges program in Germany, Austria, and Hungary. The focus of the study will be the culture of the countries, their history, traditions, environments, politics, economics, art, and society! With "opportunities to meet and converse with a variety of host country citizens." . . . Don Severance has been extremely busy preparing, with Phyl's help, to close their Wellesley home and move to Exeter, N.H.

Harold Strauss's note expressed disappointment that he and Henrie could not attend Endicott House this year. But thinking of the mini recalled for him some of the highlights (?) of our years at the Institute. Harold is one of the historians of the class, with a collection of clippings and photos—Field Day, the car hanging from the fifth-floor roof, innumerable snapshots of graduation and reunions, etc. "P.S. My laziness has now extended to using the computer for correspondence!"

"After a winter in Florida," Ed True reports, "We are now back home in Maine." Looking at a schedule of family gatherings, Ed says, "Perhaps next year we can avoid having all the important events occurring simultaneously the first weekend of June. Millie and I would like to convey our regards and best wishes to all who were smart enough to figure out how to get to the mini-reunion!" . . . Bill Shamban wrote that he and Sophia would like to attend, but because of uncertainties they would make a last-minute decision. (They didn't make it.)

For our maxi-reunion planning, the MIT statistics on the most recent 60th Reunions show that we can expect about 40 of our active alumni/ae to attend. Aside from the coordination with Alumni/ae Week, what program would be the most desired and relevant? (Maybe you've noted from the Notes of preceding classes in the *Review* the programs they have selected?) Our "decision window" does not close for a while, but as you read this, reunion is only 44 months away! Again, send your suggestions to Fred.

We have received news of the death of Abbott Byfield on May 22 in Fort Meyers, Fla. Ab joined us in Course X after a checkered younger life: born in Chicago; attended Denny School in Paris, France; North Shore School in Winnetka, Ill.; Northwestern University; and then MIT. After graduation he joined many of us in X-A, and then returned soon to the Institute's support of Army weapons development. His later career included 32 years with Kimberly-Clark Corp., where he served in research and development capacities, and later as assistant to the president and

head of public affairs. He was a member of the Wisconsin Committee on Improved Expenditures Management, and a long-time member and officer of the United States Power Squadrons of Wisconsin and Florida.

In retirement, Ab served in many public capacities in both Door County, Wisc.—as president of The Ephraim Foundation and Friend of the Peninsula Music Festival—and in Florida as board member of the Sanibel-Captiva Conservation Foundation and the Island Water Association. He is survived by his wife, Elizabeth, three children, five grandchildren, and two great-grandchildren.

As these notes were being prepared, Paul Des Jardins, Course XV, has agreed to become secretary of our class. Paul reached the rank of captain in the Navy during World War II and Korea, and is retired from the management of Worthington Pulp.—Paul R. Des Jardins, secretary, 6241 Old Dominion Dr., Apt. 310, McLean, VA 22101-4807, (703) 534-4813; Gretchen Birge, assistant secretary, 233 Carroll St., Apt. 202, Sunnyvale, CA 94086-6264, (408) 736-5011

39

Fred Grant, chair, and the 55th Reunion Committee outdid themselves on behalf of 64 '39ers and their 60 guests.

The committee included Joe Dana, Jim Barton, George Beesley, Burns Magruder, Jr., Manning Morrill, Fred Schaller, Sid Silber, Paul Stanton, and Bill Wingard. Special thanks go also to MIT staff who helped.

On Tuesday, 22 persons were bussed to Newport, R.I., where they joined other '39ers.

ClassNotes

On Wednesday, they toured Newport, its mansions, and harbor. Seymour Sheinkopf's and Hal Seykota's color slides were projected before dinner. An hour-long tape of the life and achievements of classmate Richard Feynman was shown. Len Mautner, Maurice Meyer, and Pete Bernays volunteered anecdotal reminiscences.

Fred Grant read regrets at class meeting Thursday from Dodie Casselman, Richard Guthrie and Isabelle, Charles Wang and Julia, Bill Wingard and Anita, and Aaron White and Edith. The Wang's address is 13715 Sunkist Drive #202, La Puente, CA 91746. They express gratitude to those who helped resettle them in the U.S. and invite classmates to write about old times and their new activities in California real estate. Mary Barton circulated a get-well card for Dodie Casselman/Griffin. On June 9 Dodie was home convalescing.

Earl Reynolds and Carolyn brought a copy of *The Tech* published in June 1939. It names classmates who received bachelor degrees in 1939. Earl volunteered to mail a photocopy to each classmate who requests. Send a self-addressed envelope and enclose three 29-cent stamps to 6283 Eagles Lake Drive, Cincinnati, OH 45248-6867.

Class Officers for the next five years are Manning Morrill, president; Oz Stewart and Jim Barton, vice-presidents; Joe Dana, treasurer; Hal Seykota, secretary; Ernie Kaswell, class agent; and Len Mautner, class estate secretary.

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What's a V-Disc? As one might guess, V is for victory, and the discs (12-inch vinylite records) carried sounds of the great musical artists of the day to the American troops overseas to help boost morale during World War II.

When the Navy joined the V-Disc Program, it's not surprising that they appointed E.P. "DiGi" DiGiannantonio, '40, as officer-in-charge: he was a Navy officer (a lieutenant commander wounded in action during the sinking of the U.S. cruiser *Vincennes*) and he had big-band and recording experience. While an aeronautical-engineering student at MIT, DiGi had organized an 18-piece dance band. He had also recorded Benny Goodman, Glenn Miller, and other Boston area bands.

The V-Disc program operated from October 1943 to May 1949, representing the only music recorded during the American Federation of Musi-

cians recording ban (August 1942 to November 1944); recorded performances during the ban were for the services only. "Another unique thing about the discs," DiGi says, was that "we got artists from different labels to sit down and record together. That included Tommy and Jimmy Dorsey, who were on different labels in those days. Under normal circumstances, that would never have happened."

Recordings were done live in a night club, on a movie set, in hospitals, and sometimes even aboard a Navy ship. One song, actually called "Flying Home on a V-Disc," was recorded by Lionel Hampton on March 10, 1944, at the RCA studios in New York City. Artists included such greats as Frank Sinatra, Judy Garland, Billie Holiday, Guy Lombardo, Ella Fitzgerald, Andre Previn, and Perry Como. Many discs included personal greetings and encouraging words from the musi-

cians to the troops. More than eight million V-Discs were distributed around the world and were played in the barracks, dance halls, and even in tanks and jeeps. Kits, which were sent monthly, were packed with discs, steel playing needles, hand-cranked record players, and questionnaires for soldiers to indicate their requests. "White Christmas," "Stardust," and "I'll Be Seeing You," were among the most frequently requested songs.

"The music had a lot of feeling, a lot of emotion. It should be heard again—we could use it now," says DiGiannantonio. Because he would like the people of that generation to enjoy the music again and the current generation to hear some "great stuff," he has re-released some of these recordings on tape and CD. For more information, write DiGi at P. O. Box 2367, Reston, VA 22090.

—Sandra Knight

Sixteen '39 classmates, reported deceased between March 27, 1993, and March 25, 1994, were remembered at the Memorial Service in the MIT Chapel Friday morning. In 1939, MIT awarded 410 bachelor of science degrees, of which coeds received six. In 1994, MIT awarded 962 bachelor of science degrees, and coeds received 505. On Friday, Kresge Hall was filled with listeners to topics relevant to the Technology Week main theme "For the Wonder of It All: The Arts at MIT." Details are reported extensively in the MITnews section.

Technology Day Luncheon was in Johnson Athletic Center. About 1,300 attended and applauded President Vest's news that MIT is ranked for the fourth consecutive year as the leading U.S. university in engineering and sciences. Also, MIT's Sloan School ranked second (of 50) in business administration, just behind Stanford. Surviving '39ers number about 280-plus within about 95,000 MIT living alumni/ae.

On Friday evening, '39ers joined Class of '24 at the Cardinal and Gray Society dinner in Stratton dining room in the Student Center. Dinner was the finest. Music from clarinet and piano professionals was ever-popular old standards, and a fun sing-along developed under direction of **Morrie Nicholson**. Members of a volunteer sextet who shared a single microphone included **Nancy Smith**, **Jean Dana**, **Nick Carr**, **Don Timbie**, **Hal Seykota**, and **Morrie**. We missed **Eugenia** and **Fred Cooke**, **Mary** and **Win Reed**, and **John Alexander**, whose bass voice produces low E with authority. But those missing were compensated for in enthusiasm and volume.

Betsy and **Bob Withington** returned from helping deliver a new 747-400 in Israel, attended reunion, and sailed a Tech dinghy for several hours on Saturday. They didn't comment about jibing the dinghy versus jibing their Miller 44 and its 70-foot mast, two jibs and a mainsail, docked adjacent to their home on Mercer Island in Lake Washington.

Wendy and **Barry Graham** enjoyed the reunion. Since **Barry** had his own pontoon-equipped plane for 25 years, he might have some operating tips to offer **Bob Withington** who is now building a plane to be pontoon-equipped. . . . **Al Graffeo** continued after World War II in the U.S. Army Ordnance Department and retired as a full colonel. It was fascinating to hear he combined astrology, religion, hands-on, and faith afterward to heal numbers of people whose illnesses failed to respond to conventional treating.

Bill Pulver, master puzzle solver, and **Adie** expect to attend a grandson's wedding this summer on beautiful Orcas Island in Puget Sound. . . . **Jean** and **Joe Dana** expect to attend seminars of Elderhostel on cruises in Puget Sound during July.

Fred Grant said our reunion committee found our class responded better to drives and reunions than estimated by the Institute based on its records of preceding classes. **Ernie Kaswell** sensed intangible noticeable conviviality and fellowship among the 124 who attended. **Ernie's** conclusions were amplified by items in **Fred Grant's** packets. . . . **Fred Cooke**, **Will Jamison**, **Bill Wingard** and **Dave Lindberg** all sent regrets. . . . **Richard Leghorn** and his wife expected to be on QE2 at reunion time, headed for 50th anniversary celebration of D-Day in France. . . . **Wilbur Vincent** and his wife participated in a golf tournament in

late May, then left for Australia and New Zealand in early June. . . . **Elaine** and **Sam Sensiper** went to Orlando, Fla., to welcome their first grandchild, **Maxwell Sensiper**. . . . **Peg Whitcomb** can't remember names any more and can't see very well but sends love to all. . . . **Morgan Sze's** wife just had a stroke. . . . **Esther Garber** was considering a date for hip replacement. . . . **Ruth Pitt** was committed to be in Washington, D.C., at reunion time. . . . **Lolita** and **John Renshaw** were committed to be in Washington, D.C., and California.

Before reunion, **Pete Bernays** wrote to each Course V '39er. Responses followed. . . . **Lenore** and **Mark Curgan** traveled extensively in Scandinavia. After attending the 55th, they plan to visit in Rome, France, Spain, and Portugal. . . . **Lucille** and **Mel Falkof** served in Egypt for the International Executive Service Corps and as chairman of the Chicago chapter of the Service Corps of Retired Executives. They will attend the 55th before re-visiting Israel. . . . **James H. Schulman** completed consultations for the National Academy of Engineering and the National Materials Advisory Board. Now he studies the more fundamental aspects of physics and chemistry.

Manning Morrill's cheerleader letter caused responses to flow to class treasurer **Joe Dana**. . . . **Burt Rudnick** continues active in real estate, but was away from the U.S. during the 55th. . . . **Mrs. Thomas B. Akin** (**Marguerite**) was in the process of moving. . . . **Betty** and **Joe Neuendorffer** are 50 years married, active, and regretted having to miss the 55th. . . . **Gus Hunicke** was trying to overcome his grief and, with mingled feelings, decided it was best for him to send his best wishes to all classmates and pass attending the 55th. . . . **Dorothy (Mrs. Ed M.) Tatman** reported they had to forego the 55th for health reasons and they hoped the sun would shine on all the festivities. . . . **Berta** and **Larry Perkins** interrupted their growing corrugating business to attend the 55th.

The rate at which classmates died during the last year was about three persons per two months. Now might be a good time to review wills and other estate planning pre-need documents to confirm they specify precisely what the testators intend, updated to now.—**Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407

40 55th Reunion

Last month, I mentioned a letter from **Fred Noonan** about his visit to Plymouth. I wrote to let him know that it would not appear in time for anyone to meet him. He responded by writing, "We are all getting old and perhaps we should provide our obituaries early so they can be published in a timely fashion." Things aren't quite that bad, so don't send me any preliminary obits.

Here is a continuation of the list of class members whose whereabouts are unknown: **Robert B. Goodwillie**, **Alfred J. Green**, **Harold Hershfield**, **Leslie G. Higgins**, **Harold R. Hobkirk**, **William Z. H. Hwa**, **Bunlua Jubandhu**, **William P. Lamb**, **Richard D. Lee**, **Moses C. Long**, **George J. Lorant**, **Donald E. Macharg**, **Ernesto T. Mendoza**, **Herman L. Meyer**. More names will be included in the next column.

ClassNotes

Bill Hecht, Executive VP and CEO of the Association of Alumni and Alumnae of MIT, sent a letter to the MIT Club of Northeast Ohio notifying the club that it will receive one of the 1994 Presidential Citations for its Materials: 2001 seminar, jointly sponsored with the Case Western Reserve Alumni Association. Also recognized is **Norman Klivans'** participation as the key organizer of the event. The award was to be presented at the Awards Luncheon of the Alumni Leadership Conference in Cambridge on Saturday, September 24, 1994.

By the time you read this, you will have received the mailings from **Walter Helmreich** regarding the 55th reunion class gift. You may also have received a follow up telephone call from one of the 22 volunteers who have offered their assistance to **Walter**. If you haven't yet made a pledge, and are so moved, please send it in as soon as possible.

The reunion committee co-chairs, **Sally Bittenbender** and **Bill Stern**, along with class president **Norman Klivans** have been confirming arrangements at Woodstock and at Cambridge, and you should receive a detailed mailing to the whole class. Thereafter, only those who have indicated that they expect to attend the reunion will continue to receive further information.

Please send information for the notes to Class Secretary **Richard E. Gladstone**, 250 Hammond Pond Parkway 1205 S, Chestnut Hill, MA 02167-1528, (617) 969-5161

41 The August/September Notes incorrectly reported the death of **Luis G. Jiménez-Michelena** as December 13, instead of the correct date, December 14, 1993.

The brief obituary which followed was based on a letter from his wife and abstracts from the 1941 *Technique* and MIT *Alumni Registers*. A more complete obituary just received from MIT provides interesting details of his distinguished career.

Returning to his native Caracas, Venezuela, after graduation, **Luis G. Jiménez-Michelena** was employed in the Venezuelan government's Ministry of Communications. From 1943 to 1946 he worked with ITT-Standard Electric in Brazil developing a long-distance radio system for northern Brazil. Returning to Venezuela in 1946, he became chief engineer of the Ministry of Communications and professor of electrical engineering at the Universidad Central de Venezuela. In 1947 he formed his own company of consulting engineers, **Intelec, S.A.**, designing radio communications for several American and other oil and iron ore mining companies operating in Venezuela. His company became exclusive distributors for **RCA Communications, Inc.**, which cooperated in this effort. In 1952 his company was awarded the contract for planning, design, and installation of the first TV station in Venezuela. In 1954 he became a member of a committee to study a long-distance communications system for the whole of Venezuela. The contract was awarded to his company and work started in 1955, and the system was delivered one year



The Kindness of Strangers

Sometimes an unexpected gesture from strangers touches us all." So read a grateful letter to the *Camden Herald* some weeks after members of the Class of '44 marched in the Memorial Day parade in Rockport, Maine, and left their impression of friendship and generosity on its citizens.

The encounter began when the class launched its 50th Reunion at the nearby Samoset Resort. David Yablong, a Scout leader with 14 Memorial Day parades under his belt, read about the upcoming celebration in the local paper. Looking around at classmates proudly clad in red jackets, he saw a ready-made marching unit, so he offered a proposal: "Why don't we march in the Memorial Day parade?" As he tells it, there was a spontaneous affirmative response—seconded by the Rockport parade committee.

The event was typical of small-town parades staged all across America, replete with fire engines and and police on horseback. "We stepped 20 strong with the '44 banner in the lead, behind the parade band and followed by the Rockport Library contingent, which was celebrating its

80th birthday," reports Yablong.

Most the class were World War II veterans, for whom the holiday was particularly memorable this year. All the more so for Alf Bjerke, of Norway: celebrating his 79th birthday, remembering the wartime death of his brother, and startled to be greeted in Norwegian on the streets of Rockport by a neighbor from home who happened to be visiting a sister in the States.

After a ceremony at the cemetery, the class joined the rest of the community in the Rockport Library birthday festivities, complete with home-baked goods. Touched by the hospitality of the library association, the class decided to show their appreciation by creating a lottery, to which Alf Bjerke donated four copies of *Norway*, a historical picture book he wrote. They raised \$275 for the library-building expansion fund. The library also received an autographed copy of *Norway*, inscribed by author Bjerke: "Remember, there were never any horns on Viking helmets," as well as a copy of the *Class of 1944 50th Reunion Book*, with an inscription by editor Lou Demarkles. □

—Susanne Fairclough

later. From 1957 to 1967 he was again a consultant to the government in telecommunications involving a microwave system and satellite communication system for eastern Venezuela. In 1974 he was nominated a special consultant and delegate of the Venezuelan Telephone Co. to the Spanish Telephone Co. for a project to install the first submarine

cable between Spain and Venezuela. The cable, christened "Columbus I," was inaugurated on October 12, 1977. He retired to Madrid, Spain, in 1977 but continued close contacts with his fellow engineers, both in Venezuela and in Spain. Due to heart problems and general poor health he could not attend our 50th Reunion in 1991.

The February/March Class Notes briefly mentioned conversations with two adventurous classmates as they passed through Washington. Quentin Wald's promised follow-up letter appeared here in July. Connie Nelson writes his story from Minneapolis, Minn., leading us into his extended visit to Japan. "In 1979 I began taking Japanese painting lessons from a woman whose father was the Japanese ambassador to Mexico during World War II. I am still continuing with them. Minneapolis' sister city, Ibaraki (not to be confused with the Prefecture of Ibaraki northeast of Tokyo), is a suburb of Osaka. Its claim to fame on the world scene is as the home of Nobel Prize (Literature) winner Kawabata. My teacher arranged for a series of cultural exchange visits to Ibaraki starting in 1985. Our group, the second, visited Japan for a month in the summer of 1987.

"During our stay we were treated like long-lost relatives, both by the Ibaraki government and by the local members of our mutual cultural association. We stayed in their homes part of the time, were wine and dined, and provided free transportation everywhere, including Nara and Kyoto. Certainly the highlights of our stay were the free lessons in the folk arts of Japan by masters in each field: ikibana, folk dance, folk singing, calligraphy, oshi-e, tea ceremony. It was during one of the oshi-e lessons that a television crew from NHK showed up to obtain material for a weekly program about activities in the Kansai region, to be broadcast nation-wide a few days later. Somehow the head of the television crew heard that we had learned one of their folk songs. She asked me to sing it and I did! The program was broadcast as scheduled. Our segment probably lasted no more than 3-4 minutes and my singing no more than one. Since then, our cultural contacts with Ibaraki have been practically nonexistent, although commercial contacts are being maintained through other Minneapolis representatives. Our painting class's cultural activities are now involved with another city, Akita, probably because U. of Minn. established a campus there a few years ago. A group of Akita artists visited us in 1992. They painted with us and presented us with some of their work. We reciprocated last year by sending at least one painting from each Minneapolis student for inclusion in their annual art exhibition. We asked that, after their exhibition closed, our paintings be given to the artists who had visited us. My understanding is that they were distributed by a free raffle. In January 1994, I received a hand-painted thank-you card from the woman who now has my painting."

Connie's sojourn in Minneapolis began in 1978, as a short visit to his daughter, before heading South for the winter. He liked the area so much that he hasn't left it since except for short trips. His life there is apparently very full. In addition to his art classes his volunteer activities include: manning the Visitor Information Center at the Minneapolis Institute of Arts; giving talks to visiting groups on the institute's permanent collections and traveling exhibitions; a former head of the Volunteers Speakers Bureau, he now is one of the speakers, but has been involved in several special museum projects; volunteer math and science teacher at Minneapolis' general magnet high school; reading Great Books, of the Western World; studying Danish and Japanese. Con-

nie's interest in the performing arts had him attending many plays, classical and baroque concerts, operas, recitals, etc. (thirteen season tickets one year, now cut back to seven or eight). He's a past board member of the Frederic Chopin Society, continuing on the boards of the Danish American Fellowship and the Geological Society of Minnesota.

Robert L. Sinsheimer's autobiography, *The Strands of a Life: The Science of DNA and the Art of Education*, published by the University of California Press, is the latest in the Science Book Series commissioned by the Alfred P. Sloan Foundation to foster public understanding of science. Our class does not have to be reminded of Bob's distinguished career in the biological sciences, including important positions at Iowa State and UC/Santa Barbara (professor), Caltech (professor and head of the biology department), and UC/Santa Cruz (chancellor). His earlier roots were at MIT—undergraduate and PhD studies separated by four years at the MIT Radiation Laboratory. His breakthrough work on the bacterial virus ϕ X174 was conducted during his 20 years at Caltech. The best known result of this work, that the DNA of this virus is single stranded, was announced in 1959 in the first issue of *The Journal of Molecular Biology*.

Using this virus, Bob's group was the first to isolate a "pure" DNA, which material was for 20 years the basis for pioneering work in chemical genetics. Bob's students became leaders in this field. One of them, Clyde A. Hutchison, the Kenen Professor of Microbiology at the University of North Carolina at Chapel Hill, provides an interesting and more complete review of this book in the Spring 1994 issue of the Caltech Alumni Journal, *Engineering and Science*. In it he lauds Bob's respect for the scientific process and quotes his concluding remarks. "I would love to return in a century or two to see where science stands and to learn what questions they are asking in the Sinsheimer Laboratory (at UC/Santa Cruz.)" Hutchison provides his own conclusion, "When the technology to realize this dream becomes available, he certainly deserves to be high on the waiting list."

As the 25th anniversary of the Apollo Manned Lunar landing approaches (July 20, 1994), I am reminded of the many classmates who participated in the program, as shown in their biographies in the 25th and 50th Reunion Yearbooks. None played a more important role than **Joe Gavin**, the director of the Lunar Model Program at the NASA prime contractor, Grumman Aerospace Corp. Later president and COO and now retired, Joe was interviewed for the July issue of *Technology Review*. If you missed it, dig out the article and get Joe's reminiscences of an exciting era, thoughts on converting the defense industry to peacetime activities, and the future of the U.S. space program.—**Charles H. King, Jr.**, secretary, 7509 Sebago Rd., Bethesda, MD 20817, (301) 229-4459

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Lee Martin writes that on their round-the-world trip last April and May, they spent two days in Beijing with **Norman C.Y. Chow**. Lee also gave the new "English"

spelling of his name, which is "Norman X. Y. Zhou." Note the educational value of reading

your Class Notes! Norman spent most of his career working for the Chinese government and retired as VP of the Management Institute and as senior engineer at the Ministry of Machine Building in Beijing.

Rhoda and Alan Katzenstein attended the Dallas meeting of the MIT Council for the Arts. **Ed Vetter** was a member of the Host Planning Committee in Dallas, which did a spectacular job managing the weekend of art, architecture, and music. So we are not solely about science and math!

Two obits: **Jim McClellan** and **George Anderson**, both graduates of Course V. Jim worked for Dewey and Almy and later as a VP of Weyerhaeuser Paper Co. George was with Canadian Industries, Ltd. from 1942 until 1968 and then taught at St. Lawrence College. Our sympathy to their families.

Thanks for the news that you've sent our way. Can always use more!—**Ken Rosett**, secretary, 281 Martling Ave., Tarrytown, NY 10591

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Kenneth R. Wadleigh, former MIT vice-president, dean of students, and dean of the graduate school, died on July 21 at age 73. A full obituary for Dean Wadleigh by John

Mattill, editor emeritus of *Technology Review*, will appear in the November/December issue.

Newton I. Steers, Jr., of Bethesda, Md., passed away February 11, 1993. He is listed as a member of our class, although he did not receive a degree. No other information is available. . . . **Hugh L. McManus**, Department of Aeronautics and Astronautics, is the latest holder of our Class of 1943 Career Development Professorship. Professor McManus has aero degrees from MIT and Stanford. Since joining the MIT faculty in 1991, he has received recognition and several awards for teaching excellence and creative leadership in the classroom. His research interests include advanced composite materials, thermal structures, and space structures. He follows a series of other distinguished faculty members who have held this professorship since it was established by our 35-Year Reunion Gift.

Herb Twaddle and wife **Barbara** attended Barbara's 55-year high school reunion in Tulsa in May. Being also a member of that class, your secretary was able to greet them and pick up some personal news. Herb and Barbara regret missing the Class of '43 Reunion in Maine last year, but they have a good excuse: a family marriage in Pisa, Italy. Their second son, while working on a PhD in immunology at the University of Chicago, met a young Italian lady doing research in the lab across the hall. Their acquaintanceship blossomed into romance and an international marriage. The bride is now going through the rigorous procedure of qualifying as an internist in the United States, interrupted by a return to Naples to defend her PhD thesis in biochemistry. All this while expecting a baby. I have not met either of these young people, but I feel intimidated.

The *Chicago Tribune* of April 11 carried a lengthy article about **Walter Netsch** in his role as husband of the Democratic nominee for governor of Illinois. With a degree in architecture from MIT, Walter served in the Corps of Engineers during World War II, then joined

ClassNotes

Skidmore, Owings & Merrill in 1947. He designed the Air Force Academy Chapel in Colorado Springs, as well as numerous buildings in the Chicago area. He married **Dawn Clark** in 1963 and took early retirement in 1979 after suffering a heart attack. Since that time, he says, he has not held a paying job. From 1986 to 1989, he served as member and president of the Chicago Park District Board. Much of the family support in recent years has come from a fabulous deal through which he sold for \$2 million a painting he had bought many years earlier for \$600. As an architect and administrator, Walter has been called radical, controversial, and ahead of his time. Other terms include "genius," "elitist and aloof," and "curmudgeonly." He is widely recognized as one of Chicago's most important living architects. His ambition now is to move to Springfield as First Husband of the governor. Can anyone else compete with Walter's tale?—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114

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"In accordance with our traditions, members of the 50th reunion class—the Class of 1944—are participating in these ceremonies. This class entered the Institute before the

United States entered World War II, and may have had the expectation—not held by later wartime classes—of a normal completion of their undergraduate studies. For most members of the Class of 1944, this was not to be. Records of the Institute indicate that of all the wartime classes at MIT, the Class of 1944 may well have experienced the greatest disruption. Most who entered with this class did not receive their diplomas until after the war, if at all. Many did not return from the war. Today, as you return to Tech for your 50th Reunion, we extend a special welcome. May your participation in these commencement ceremonies recognize and reaffirm your very special place in the history and the family of MIT."

With these words at commencement exercises on Friday, May 27, Chairman **Paul Gray** departed from the usual program to pay special tribute to our class. His acknowledgement of the difficulties faced by the class of 1944 made for a particularly touching moment at the 50th Reunion. Those of us present will not only remember that tribute for a long time, but also have etched in our memories the reaction of more than 1,700 graduates—a spontaneous and prolonged standing ovation. But there was more. After the singing of our alma mater and "Take Me Back to Tech," we marched out between the ranks of the graduates to the tune of "Auld Lang Syne," and again there was a standing ovation all down the Great Court. If there was a dry eye in the Class of 1944, it went unnoticed by your reporters.

It was an impressive start to a very successful reunion, highlighted by the class trip to Maine, our special reception at the President's House, the Pre-Pops Dinner at the Faculty Club, MIT night at the Pops, the Post-Pops



Fans of the '44 Crew team should be sure to read the reunion article by Diana ben-Aaron, '85, which begins on page MIT 1 of this issue.

Gathering in McCormick, Class President Ed Eaton's presentation at the Technology Day luncheon of the class gift of over \$6 million, the class photograph, and the grand finale of the dinner dance at Walker Memorial, billed as a bit of nostalgia. Reminiscing, renewals of old and the start of new friendships were the order of the evening. We also enjoyed meeting some of the present-day students who tried our '40s dances and loved them.

After the graduation ceremonies on Friday, the class traveled to the Samoset Resort Hotel in Rockport, Maine, via bus—some on Sunday, May 29, and others on Monday, May 30. Dave Yablong, '47, read that the town of Rockport was holding its Memorial Day celebration on Monday. After contacting the parade marshal, our class was invited to march in the parade. With Norm Sebell and Lou Demarkles carrying the class banner, followed by a distinguished group of '44s, we marched behind the town band riding on a flatbed truck. We received applause all along the way, but are not sure whether some of the spectators thought we were D-Day veterans. After the memorial ceremony at the town cemetery, we were served cupcakes courtesy of the town library, which was celebrating its 80th anniversary. One of the servers was a member of the Class of 1943!

That evening, Alf Bjercke raffled off four copies of his book *Norway*, and the proceeds of \$275 along with copies of *Norway* and our 1944 50th Reunion Book were presented to the Rockport Library. We have just received a wonderful letter of appreciation from the trustees. Both books are now on display in the library. Tuesday evening, at the outdoor lobster bake on the hotel esplanade, we were buzzed seven or eight times by the "Red Baron" flying a World War II vintage airplane from the Owl's Head Air Museum. In addition, we had a cartoonist going around drawing amazing cartoons of people's wishes as a keepsake.

Next day, we visited the museum for a tour

and picnic barbecue. Two classmates won a ride in a classic biplane. That evening, Professor Warren Seering of the Mechanical Engineering Department at MIT gave a dramatic presentation of how students are taught the application of theory to hands-on design and building of real machines and an overview of teaching at MIT today to the delight of everyone.

On June 3, the class officers for the next five years were elected: Edwin G. Roos, president; James B. Angell, Lawrence C. Biedenharn, Jr., Langdon S. Flowers, C. William Ritterhoff, Paul K. Tchang, Edward B. Walker III, and William A. Wynot, vice-presidents; Edgar P. Eaton, Jr., and Stanley W. Warshaw, honorary vice-presidents; Louis R. Demarkles and Frank K. Chin, co-secretaries; Norman I. Sebell, treasurer; and E. Alfred Picardi, class agent.

No great reunion such as ours happens without a great deal of planning and work. Assisted by the Reunion Committee, Norman Sebell, our reunion chair, put in countless hours planning and settling all the many details. Many classmates and MIT staff members worked hard to ensure the success of this reunion. Of all these, special mention must be made of Eliza Dame and Bob Blake. Eliza guided us every step of the way, always being there when we had a question, making first-rate suggestions, working us through the MIT bureaucracy—and always with the cheerfulness that is her hallmark. We are in her debt. Bob guided us through commencement and took care of all the daily details while in Maine, which freed us to enjoy the reunion. He was truly indispensable as chief of staff.

These notes are the last for one of your co-secretaries. Andy Corry is leaving and will be replaced by Frank Chin. Andy has enjoyed his tenure, especially the opportunity to work closely with Lou Demarkles—a stalwart of this class in more ways than most of us can count.—Co-secretaries: Andrew F. Corry, P.O. Box 310, West Hyannisport, MA 02872; Louis R. Demarkles, 77 Circuit Ave., Hyannis, MA 02601

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50th Reunion

Reunion time! Make your plans now to attend our 50th in Cambridge and Prout's

Neck, Maine, next June. . . . Bob Maglathlin indicates that your biographical data is not coming in as rapidly as we had anticipated. Please forward your information promptly as your classmates eagerly await the receipt of our 50th Reunion Book.

In early May your Reunion Committee spent a most enjoyable afternoon at the MIT Museum reviewing issues of *The Tech*, *Voodoo*, and other undergraduate publications of our era in an effort to develop filler material for our Reunion Book. Our freshman class data was most sobering as it reminded us of how many classmates left in 1943, never to return from World War II.

On a more positive note, 94 of you (out of an active class role of 235) have paid your class dues, and Jim Pickel, class treasurer, thanks you. We can add that two members paid twice; they will be surprised when they check their bank balances! . . . In an effort to spark interest, here are a few one-liners received with class dues. . . . Jeff Jeffries has requested non-alcoholic beverages and they will indeed be available. . . . Bill Loeb divides his time between

Florida and West Stockbridge, Mass.—we wonder where his legal residence might be! . . . George Dvorak of Seattle definitely plans to attend. . . . George Brothers complains that he has not played golf in 30 years; do you suppose he is setting us up for a few sucker bets? . . . Mario Wunderlick of Guatemala City will be on hand, and Les McCracken can't wait.

Ed Stoltz has complained about the length of the reunion. We will all agree that nine days is a long time; unfortunately, the timing of June 1995 activities is the result of a faculty decision that the academic year should be extended by one week—a good decision that has caused some initial logistical difficulties. Fortunately, our meteorological friends and *Farmer's Almanac* promise good weather. . . . The June 10th issue of *The New York Times* had a great picture of Paddy Wade walking up Park Avenue by St. Bartholomew's Church. Paddy and Jephtha were in the Big Apple to celebrate the 200th anniversary of the birth of Commodore Cornelius Vanderbilt.

R. Duncan Luce, distinguished professor of cognitive science and director of the Institute for mathematical behavioral science at the University of California at Irvine, was elected to the American Philosophical Society at the society's annual meeting in Philadelphia on April 22. . . . We are sorry to report the death of Dr. Geno D. Bagno of Greensburg, Pa., on November 22, 1990.

The usual crew of Gallagher, McNamara, Meade, Charles Paterson, Maglathlin, Rickel, and Springer attended this year's Pops. George Berman was absent due to some Harvard activity—a case of mixed priorities!—Clinton H. Springer, secretary, P.O. Box 288, New Castle, NH 03854

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Please send news for this column to:

Jim Ray, secretary
2520 S. Ivanhoe Pl.
Denver, CO 80222

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One letter this month, from **John Kellett** in Houston. John spent a couple of days in April visiting MIT and had some fascinating glimpses of the Institute today. Among other things, he had a tour of the holography exhibit at the MIT Museum and visited the Artificial Intelligence Lab.

In 1992 John formed the John Steven Kellett Foundation, of which he is president and treasurer. The Foundation's purpose is to fund grants to other non-profit organizations or to undertake projects itself, directed toward the goals of equal rights for, and the elimination of discrimination against, individuals in our society.

We received delayed notice this month that **James McCoy** of Detroit died in July 1993. We have no other information.—**R.E. "Bob" McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Peter Saint Germain was elected to the MIT Corporation for another term. He was first elected to the Corporation in 1989. When Peter retired from Morgan Stanley in 1982, he

was elected an advisory director of the firm. . . . **George Clifford** and his wife, Virginia, are happy to report that their son-in-law, Paul Welcomer, was appointed second trombone in the San Francisco Symphony Orchestra. Paul was selected from 175 applicants. Paul and his wife are living in Lafayette, Calif. . . . **Albert Kelly** left his position in the Pentagon as deputy undersecretary of defense for international programs following the 1992 election and returned to Milton, Mass. He has joined the Kennedy School at Harvard as a fellow in business and government. Besides teaching he has undertaken a research project on "restructuring defense" which may lead to a book. . . . In a brief note typical of **Maurice Rifkin**, he states: "I retired from the Mitre Corp. at the end of September 1993 after 34 years."

Recently I was on the West Coast to visit my son, Clifford. We enjoyed the beautiful drive along the California coast passing Monterey and Big Sur. In Pasadena we visited **Bill Zimmerman** and his wife, Eileen. While sitting in Bill's study, the phone rang. Bill was surprised to hear **Bill Maley** calling from the Los Angeles Airport inviting Bill and Eileen to have dinner with him and his wife, Betsy. While Bill and Betsy negotiated L.A. traffic, I swam in the heated pool in Bill's yard. Clifford had prior plans, but the five of us enjoyed a sumptuous Chinese dinner. We speculated about the odds of two East Coast alumni visiting Bill on one day.

The next morning after breakfast, Clifford and I visited Tournament House, headquarters of the Rose Bowl organization. I wanted to see the stained-glass rose and two related side panels mounted over the entrance door to the business office. My sister, pushing her crafts skills to the limit, had made the rose in 1988 for the Tournament House.

Lucien Schmit, professor of engineering emeritus at UCLA, has been selected as the first recipient of the AIAA Multidisciplinary Design Optimization Award. The award recognizes his work in aerospace engineering. Lucien was elected to the National Academy of Engineering in 1985.

Don Atwood died in April 1994 a few hours after surgery for a bleeding ulcer. The hospital said he suffered a heart attack as a complication of the surgery. He was buried in Haverhill, Mass., where he was born. Don began serving his second term as member of the MIT Corporation in July 1993. His other MIT activities included membership on the Development Committee, the Executive Committee, and the Mathematics Visiting Committee. He had been a Sustaining Fellow Life Member since 1987. He received the Corporate Leadership Award in 1987 and the Bronze Beaver award in 1988.

Don served in the U.S. Army from 1943 to 1946 and returned to graduate with our class. After earning a master's degree in 1950, he joined the technical staff of the Instrumentation Lab working on inertial guidance. In 1952, he joined Dynatrol Corp. and remained with the company until it was acquired by GM in 1959. At GM's AC spark division in Milwaukee, he directed GM's aerospace program which contributed to the guidance and navigation systems for the Apollo moon landing program. In 1981, he was named vice-president in charge of GM's electrical components group. He also oversaw the company's worldwide truck and bus group. Later he was promoted to executive vice-president and was elected to the board of directors, and in 1987 he became vice-chairman. At the time of his death he still sat on the board. Robert Stempel, former chairman of GM said, "Don will be remembered by his friends at GM as the man who brought the automobile into the electronic age. Under Don's guidance, technology originally developed by the aerospace industry was reliably produced for high-volume low-cost applications." Don ended his 30-year career at GM when he was called to the Pentagon by former President Bush for his business and financial expertise.

Don was deputy secretary of defense under Secretary Cheney from 1989 to 1993. He was responsible for day-to-day management of the Defense Department. He streamlined information processing and updated financial management of the bureaucratic behemoth. Don and his wife, Susan, had been living in Franklin, Mich. On behalf of our classmates I extend our sympathy to Susan and her family.

Philip Williams died in April 1993. He had been living in Massapequa Park, N.Y., and had worked for Grumman. On behalf of our classmates I extend our sympathy to his family.—**Marty Billett**, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

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At a time in the early '50s when electronic devices contained vacuum tubes, **Thomas Brown** recognized that transistors did the job better and might be the basis of a promising business. Accordingly, in 1956, he and fellow engineer R. Page Burr founded Burr-Brown Corp., which today is one of the oldest continuously operating semiconductor companies in the world. In the beginning, the plan was that Burr would design transistors in his Cold Springs Harbor, N.Y., garage while Brown would make and sell them from his Tucson, Ariz., garage. Today, after 38 years of hard work and shrewd management, the company employs 1,600 worldwide, with predict-

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ed sales of \$200 million. Among the luminaries on the Burr-Brown board of directors is John Anderegg, board chair of Dynamics Research Corp.

According to the 1994 edition of the MIT Alumni/ae Register, **Chester Patterson** lives in San Jose, Costa Rica, but has a business, **Tecnico SA & Affiliates**, in Miami. His company sells products for fluid motion (hydraulics, air), industrial electronic controls, steam specialties, and industrial laundries. Recently his son joined the company—a source of great satisfaction to his father. Chester has no plans for retirement, but has cut back on business travel while greatly increasing his recreational sailing.

Bob Griggs skied in Switzerland back in January and skied again at Snowmass, Colo., in March, but otherwise made time fly until reunion by working hard. He is now special counsel to McDonnell, Valdes, Kelley, Sifre, Griggs and Ruiz-Suria in San Juan, Puerto Rico, and no longer managing partner. "Less hassle, less dinero!" he explains. . . . **Martin O'Brien** retired from the metal castings industry in 1992.

At the 45th Reunion Banquet, Friday night, June 2, I bumped into **Al Kenrick**, one of my old dish-hustling buddies from Walker Cafeteria days whom I hadn't seen in 45 years. Al is developing a typewriter that, from what I understand, and I'm probably wrong, works like this: you type a letter or word on an ordinary keyboard and the machine searches out and prints the corresponding ideogram from Chinese, Japanese, Taiwanese, or Korean. To write a letter, say, in these languages, one must choose from among a bare minimum of 3,000-plus ideograms. Given the size of the Asian office equipment market, Al just may be on to something.

At this same banquet, a Nominating Committee (**Mal Kurth** and **Frank Hulswit**) presented a slate of officers as follows: **Mickey Ligor**, a born leader, president; **Harry Lambe**, good at arithmetic, treasurer; and **Fletcher Eaton**, a spelling whiz (example: "hippotamus"), secretary.

The festivities at the Belmont Hotel in Bermuda were a smashing success according to many of the returning attendees. The enormous pool at the hotel was the main attraction, while the Belmont's strategic location made it easy to reach any activity. Of the hard-working members of the Reunion Committee, two deserve special mention: **Tom Toohy**, immediate past president of the class, and **Pam Ligor**, wife of the incoming president. Both shouldered heavy burdens.

Nell and I are deeply saddened, as I'm sure all of you will be, by the death of **Helen Camboureilis**, wife of **Pete Camboureilis**. . . . A note from **Winifred Petraitis**, wife of **Albert J. Petraitis**, tells us that her husband died in Kihei, Hawaii, on May 6, 1993. He had been living there for the past seven years. . . . **Edward Chalmers, Jr.**, died March 29, 1993. I deeply regret the absence of any further information on these two men.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

Susan and **Mal** have the Reunion Committee hard at work planning our 45th Reunion next June. Please join us. . . . **Ed Friedman** spent his freshman year with the Class of '47 and the rest with our class. Ed told me that the first week's calculus class and English class convinced him to pack up and go home (proving again that Tech is hell). Fortunately, **Claude Brenner**, '47, persuaded him to stay by offering to explain the week's mysteries in 15 minutes. Claude succeeded. Ed is now professor of electrical engineering emeritus at the University of Hartford.

Dick Potts retired last year after traveling the world for 40 years with **Reliance Electric**. He has since done some consulting for them and enjoyed a vacation trip throughout New England. . . . **Sam Tennant** retired in 1991 from the presidency of **Aerospace Corp.** He serves on the Air Force Scientific Advisory Board, which deals with the technical soundness and efficiency of our military space program. Sam enjoyed the MIT trips to Africa and China, but he does not recommend travel on Chinese airlines. When home, he sails his boat out of San Pedro, Calif. . . . **Norm Champ** was appointed to the Missouri Arts Council by Governor Carnahan, for whose election Norm labored mightily. The council makes grants to support a variety of art forms from a \$4.5 million endowment. Norm's next project is to get **Al Wheat** elected to replace Senator Danforth.

Bob Plouffe has been appointed VP of **Wheat International Communications Corp.** (no relation to **Al Wheat**) in Vienna, Va., a telecommunications firm. Bob has held senior positions in this field. . . . **Mel Gardner**, in a long letter to **Bob Mann**, writes that he succeeded in finding **Fred English**, who now lives in South Harpswell on the coast of Maine. Mel and Ellen plan to sail down to Fred this summer. They have been hiking in the Rockies and found it demanding but wonderful. Mel has been elected to the boards of **S.M. Stoller Corp.** and **Fiber Business Networks Communications Services, Inc.** These and other clients keep him busy. . . . **Tom Howitt** wrote from Corning, N.Y., in response to **Jim Goff's** request to hear from other MIT Scots.

Harry Tecklenburg died last November. He was living in Norwich, N.Y., at the time.—**Robert A. Snedeker**, acting secretary, **Mashie Way**, N. Reading, MA 01864; **John T. McKenna**, secretary, P.O. Box 146, Cummaquid, MA 02637

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The American Philosophical Society is the oldest and most prestigious general learned society in the United States. Founded over 250 years ago by Benjamin Franklin, it has a highly

distinguished membership drawn from all over the world. Since 1901, over 200 of its members have been the recipients of the Nobel Prize. At its annual meeting this year, **Dr. Howard E. Simmons, Jr.**, was among the 36 newly elected members. He was joined by many other notables including Nobel laureates **Toni Morrison**, **Nelson Mandela**, and **F.W. de Klerk**. **Dr. Simmons** is a former vice-president and head of the Central Research and Development Department of **E.I. Du Pont de Nemours**.

Having retired from **Procter and Gamble** as technology leader in Environmental Engineer-

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45th Reunion

At Technology Day I had lunch with **Susan** and **Mal Green** and with **Ed Friedman**.

ing, **Howard Schwartzman** is giving and attending courses at the Institute for Learning in Retirement. . . . As head of his own publishing house, **George Shumway** is carrying into his 32nd year as an author and publisher in the field of art and the history of antique firearms.

We received the sad word of the passing of **Ernest E. Maddox, Jr.**, of Baton Rouge, La. Our sincerest condolences go to his wife, Paula.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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Please send news for this column to: **Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301; e-mail lacey@hpl.hp.com

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First and foremost, it is difficult for your secretary to write good or interesting class notes when, by and large, he (she or it) must rely on year-old questionnaire results or stilted

press releases or newspaper clippings. Thus, please do *your* part and drop me a line.

Herbert Oestreich was recently elected to the board of directors of the American Association of Neurological Surgeons. He has a private neurosurgery practice in White Plains, N.Y., and is assistant clinical professor of neurosurgery at Albert Einstein College of Medicine. After graduating from Tech, he studied at the Cornell University Medical College. . . . **Stuart Kleinfelter** has retired from

GTE Products Corp. after 37 years of service. He and his wife, **Pauline**, live in Grantham, N.H., and have two children and two grandchildren.

A year-old report from **Wallace Reid**: "I have been, more or less, retired since 1989, but am still active in the public sector, e.g., chairman, Southern Maine Regional Planning Commission since 1980." . . . **Peter Conlin**, now living in Chatham, N.J., (more than a year ago) sketches his history since graduation somewhat as follows: three years as an Air Force pilot; 15 years as a Wall Street institutional salesman; 15 years as a CPA, then retiring to Pinehurst, N.C.; shortly thereafter he "unretired" and became an investor. He is divorced and has three daughters. On another note, he adds: "Hopefully not 'wasting' a vote on Perot." [MW comment: In so voting, I thought that we "wise one-fifth" of voters were clearly saying that we reject both major party candidates and want a shake-up.] . . . **Richard Scott** reports that he retired from GE Aerospace in spring of '92 and is now doing some consulting in computer software design.

Finally, I am happy to report that I just received my first real, live letter since becoming secretary. While his handwriting is almost indecipherable, **Jeff (Everett R.) Davis** reports—as I can best understand—that: he spent 39 years with one company (W.R. Grace), 37 years with one wife, has two great kids, two grandkids, and has had two cats (the last of whom is 13 years old, still alive and, according to his vet, may outlive Jeff). Having retired in autumn 1992, he now is: a volunteer at a handicapped workshop—job title is

ClassNotes

"assistant foreman or floorwalker (this is a wonderful experience!)," an "advisor or child sitter" at a middle school stamp club, and a clerk of his church. Do you do windows, Jeff? Jeff closes notably with the following: "Just think. For more than 30 of my 39 years at Grace, manager was included in my title. Now, I'm a floorwalker, child sitter, clerk. Can it get any better?"—**Martin Wohl**, secretary, 4800 Randolph Dr., Annandale, VA 22003, (703) 354-1747

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Because of an unfortunate mix-up in the mails, we are unable to present the promised initial report on our glorious 40th Reunion in this issue. It will appear next time.

Meanwhile, send me your own news for inclusion in future columns.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430

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40th Reunion

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think about our own big 40th Reunion coming up next year. Doesn't seem possible, does it? We're sure that class officers will soon be in touch with you to solicit your participation in the planning or at least your commitment to attend. Please do! We'd love to see you all again, and the more help that we get in planning and organizing the affair, the more fun it will be for all.

George Goepfert, Course X, writes that he and his wife, Patti, spent two fantastic months in Poland in the autumn of '93 as an IESC (International Executive Service Corps) volunteer. George worked with Petrochemia Plock, Poland's largest refinery/petrochemical complex, to assist in their product costing activities. He reports that it was a great opportunity to gain a first-hand impression of the privatizing economies of Eastern Europe and to participate in the transition.

Donald Eckhardt, Course XII, sent his first-ever communication to the Class Notes (should be inspiration to the rest of you who haven't let us know about you yet), including his latest Air Force biography, from which we have excerpted a few notes of interest. After getting a PhD in geophysics from MIT in 1961, Don was employed as a research associate by MIT and by the University of Arizona's Lunar and Planetary Laboratory. He joined the Air Force Cambridge Research Laboratories (AFCRL, predecessor to the Phillips Laboratory's Geophysics Directorate) in 1963. He led the team that built the AFCRL Lunar Laser Ranging Observatory in Arizona and provided the back-up retroreflectors for the Apollo

11 mission. In 1975 he became chief of the Geodesy and Gravity Branch, and in 1983 he became a member of the Senior Executive Service and director of the Earth Sciences Division, from which post he led his division into the area of seismic monitoring of nuclear tests. Don has approximately 50 publications in geophysics, astronomy, physics, and mathematics. He has been associate editor of *Moon and the Planets* and has held several editorial positions with the American Geophysical Union. He served as president of the International Association of Geodesy (IAG) Special Study Group on Gravimetric Tests of Newtonian Gravity Law and is a Fellow of the IAG. Don is married to the former Mary V. Quigley and has four children and somewhere between three and five grandchildren (two were on the way at his writing). He retired from the Phillips Lab at the end of January, and they now live in a comfortable waterfront home in Weare, N.H., where they can take advantage of season ski passes at Mt. Sunapee and Cannon.

On a much sadder note, we must report the death of Herman Jacobs, Course XV-A, who succumbed to complications of diabetes at age 60 in Palm Beach, Fla., where he had retired over a year ago. Born in Amsterdam, Herman came to the United States from Holland with his family at age 6 to escape the Nazis. They fled to England across the North Sea in a small fishing boat on the day the borders closed after the Dutch surrendered to Germany, then came to the United States and settled in Port Washington, N.Y., in 1940. Herman received a bachelor's degree in

mechanical engineering, then a master's in business administration in a joint program with the Sloan School of Management and Harvard Business School in 1957. He served a two-year stint in the Army and married the former Carolyn Dayton White in 1960. Jacobs founded his own management consulting company, Executive Controls, in 1964, and until the 1970s he was also a director of his family's repatriated business in Holland, the linen supply firm, Linnmij NV. He was listed in *Who's Who in Finance and Industry* and his clients included many blue-chip organizations. He also wrote novels, short stories, children's books, poems, and a book on management practices. He leaves a son, Bruce, and a daughter, Bettina Poirier, along with many other relatives in the United States and Holland.—Co-secretaries Roy M. Salzman, 10643 Montrose Ave., Apt. 2A, Bethesda, MD 20814 (please note new address); James H. Eacker, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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Peter R. Hall enjoys life in South Wellfleet on Cape Cod. He retired from Raytheon in 1988. . . . Robert W. Jobes has recently retired from a career of 37 years, 7 with RCA and

30 with Westinghouse Electric as a senior program leader on military contract mechanical design. Bob plays golf, travels, and works on various projects on his beach and primary residences. Bob has three grandchildren.

Nick Kiladis of Perry Hall, Md., is celebrat-

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ing his youngest daughter Lia's graduation from Yale and her first year in the MIT Graduate School of Architecture. . . . **Arthur L. Sirkin** has been admitted to practice law before the U.S. Patent & Trademark Office.

Dick Jacobs spoke at the Technology Day luncheon as president of the Alumni/ae Association. He spoke of the work that he had done, the many Chapters he had visited, and his hopes for the future. Thank you, Dick, for your efforts.

Please send news.—**Ralph A. Kohl**, co-secretary, 54 Bound Brook Rd., Newton, MA 02161

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The news from MIT arrived during times when I was out of town for extended periods, so I have missed two successive deadlines. My apologies to the class. One of those trips

was to Brazil, where my family lived all the time I was at Tech. The ostensible reason was to attend a conference and give some lectures, but it was also the first time I had been back in 38 years. Lynda and I got to Sao Paulo, Iguaçu Fall, and Rio de Janeiro. I managed to find every house we had lived in in Rio, except for one that has been replaced by an apartment building.

Gerald Ryan writes that he recently became the chairman of his second publicly traded corporation, Rent-Way, Inc. The first was Spectrum Control, Inc. . . . **Ralph Warburton**, of the University of Miami, served on the national selection jury of the 1993 Architectural Portfolio of American Schools and Universities. He also published a biography of the late Charles A. Blessing in *Planning History Present*. Blessing, who passed away in 1992, was a Fellow of both the American Institute of Architects and the American Society of Civil Engineers, served as city planning director in Detroit for 21 years, and was the president of the American Institute of Planners.

We learn of the deaths of three classmates. **Bob Kruger** passed away on June 23, 1993. He is survived by his widow, Donna. . . . **Mary Roan Rocchio** died on January 27. Originally from Warwick, R.I., she had lived in Sherborn, Mass. She was a software engineer for Zoll Medical Corp. She is survived by her husband, Joseph. . . . **Constantine "Gus" Simonides** passed away on April 28 (see May/June, p. MIT 11). Gus had been a major figure in the MIT administration for many years. At the time of his death he was vice-president and secretary of the Corporation. He had served in the office of the president under four presidents and was involved in all aspects of life at Tech. Those of us who remember Gus well from his undergraduate days extend condolences to his widow, Betty.—**John T. Christian**, secretary, 7 Union Wharf, Boston, MA 02109, (617) 227-7521, fax (617) 720-4694

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Note: Evan Ziporyn, Class of '58 Career Development Associate Professor of Music, is featured in the article on the Balinese gamelan that begins on page MIT23 of this issue.

Please send news for this column to: **Mike Brose**, secretary, 75 Swarthmore St., Hamden, CT 06517

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Please send news for this column to: **Dave Packer**, secretary, 31 The Great Rd., Bedford, MA 01730 (617) 275-4056

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35th Reunion

Sue Schur writes: "One of my paintings (an oil on paper) was selected for inclusion in the

group show of works on paper that is being exhibited at The Boston Athenaeum. . . . My advertising business is still going well and continues to focus on technology-based accounts. The other business that keeps me out of mischief (to some extent) is my magazine, *Technology & Conservation*. In connection with the magazine, I am co-organizing/planning an international conference on 'Pest, Insect and Fungus Management: Non-Toxic Fumigation and Alternative Control Techniques for Preserving Cultural/Historic Properties and Collections.' This meeting, which T&C and Harvard's Department of Environmental Health and Safety are sponsoring, will be held in Boston on October 22-23, 1994." Sue invites anyone interested in spending a weekend in Boston to learn all about bugs, mold/mildew, rodents, etc. to give her a call.

Our class president, **Jorge Rodriguez**, writes that preparations for our 35th Reunion are moving forward under the leadership of **Tom O'Connor** and **Bill Blatchley**. **Noel Bartlett** has agreed to take responsibility for the Reunion Gift, so I'm sure you will be hearing from Noel soon, if you haven't already.

Jorge also passed along a report on our Endowment for Innovation in Education. As of April 30, 1994, the book value of our fund was \$740,815, the market value \$1,085,661. The fund is generating investment income of about \$50,000 annually. **Jorge** also provided some more information on our latest Class of 1960 Fellow, Professor **Isabelle de Courtivron**. Professor de Courtivron received the 1993 Harold Edgerton Award for outstanding teaching, with the award committee noting that she was viewed "by colleagues and students alike as an electrifying teacher. In her classes, learning a foreign language is not merely acquiring an additional skill, it is gaining access to another way of thinking, another mode of communication, another perspective on the world." She certainly is a teacher to be proud of as a class Fellow.

Finally, an article in the *Wall Street Journal* noted that **Jon Shirley**, formerly a director and consultant with Microsoft, is now chairman of the board of Mentor Graphics Corp. in Wilsonville, Ore. Congratulations, Jon.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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In February the *Boston Globe* reported on **John Sununu's** whereabouts and activities. It says he is doing well. He consults for W.R. Grace and Westinghouse (among others),

appears on CNN's *Crossfire*, and goes to Republican fund-raisers around New Hampshire. The best news is that he is much thinner—a lesson to us all. According to the N.H.

ClassNotes

Republican chairman, John can still pick up the phone and call [U.S. Government] department heads for information. Last year John and MIT classmate **Edmund Coady** started up an international banking firm called Trinity Partners. It's quite hush hush. According to the article he has also kept up his friendship with George Bush and visits Kennebunkport occasionally. The newfound income from these ventures has gone into fixing up his house and buying land in Waterville Valley—a New Hampshire ski resort—and Palm Springs.

Bruce Tarter is acting director at Lawrence Livermore National Labs until the end of the year. The University of California chose Bruce to run things until they complete a national search. The appointment was sudden and was in the wake of the unexpected resignation of the previous laboratory director. Bruce has been at Livermore for 27 years and has been deputy director since the beginning of the year.

Fred Schmidt has been a regular correspondent. In his most recent epistle he reports that his retirement plans are to go surfing. He enclosed a copy of the menu at his retirement party (in August 1993). It sounded good but the \$20 tab seemed a bit high until the fine print was noticed. The price included a gift.

We have received several interesting letters from recipients of the Class of 1961 Student Aid Fund. For instance **Wayne Lam**, '95, Course II, wrote to thank the class. He says his passion is in cars and coming to MIT puts him in the thick of it. He reports that the first couple of years at MIT were full of self-doubt but he now feels more confident and is looking forward to graduate school. **Wayne** is originally from China. Another recipient, **Ethan Crain**, is from Windham, Maine, and is in Course VI. He is a runner and spends a lot of time training for cross-country and indoor track. The Class has several other student aid projects. They are the **Clarke Swannack Memorial fund**, the **Howard and Helen Bartlett Scholarship**, and the **Alpha Epsilon Pi Scholarship**. Each has some restrictions but over the years has gone to some remarkable students. Our class can be very proud of its direct efforts to students.—**Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167, or via Internet: <andrewb820@aol.com> or <abraun@husc4.harvard.edu>

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Received news from **Dave Bragdon** with a picture of the faked MIT police car atop the MIT Great Dome. The news clipping was from the *Boston Globe*, dated May 10, 1994. I

also noted coverage in the *New York Times* at about the same time. So the MIT hack is still newsworthy, just as it was in our day! **Dave** also included a clipping from the *Ann Arbor* (Mich.) *News* concerning changes at Environmental Research Institute of Michigan (ERIM), a non-profit group specializing in remote sensing and imaging technology, working primarily for the U.S. Defense Department

(DOD). It seems that classmate Jack L. Walker, ERIM's executive VP for technical operations, has been named acting president. On June 13, 1994, Ed Feustel sent me a short e-mail note that Roger Sullivan has moved from ERIM in Ann Arbor to the Institute for Defense Analysis in Alexandria, Va. I don't know if the two events are related in some way, but that's the news from Ann Arbor and Alexandria.

Jan C. Brown dropped us a note via *Technology Review* on April 18, with the news that he is now with the New York Insurance Department as a supervising actuary. Jan became a fellow of the Society of Actuaries (FSA) in 1969. He noted that his new job responsibilities are in the "hot" fields of investments and cash flow testing.

Hal Waller sent me an e-mail message with the news that he has been appointed acting dean of arts at McGill University, where he is a professor of political science.

Received an e-mail message from Joan (Munzel) Gosink, with the wish that more of our women classmates would send in their news. Joan is at the Colorado School of Mines in Golden, Colo., where she has been division director for engineering (Civil, Electrical, and Mechanical) since 1991. [That's basically the same thing as being dean of engineering.] Her division enrolls some 40 percent of the CSM undergraduates, and is the largest division at the school. The students are very capable (about the same Math SAT scores as the students at MIT), and the rapidly growing program has a unique interdisciplinary format. The program has been expanding so fast that

they have hired six new faculty members this academic year (1993-94), including one endowed chair. A new PhD program has just been initiated in Engineering Systems which focuses on the interfaces between traditional disciplines. Before moving to CSM, Joan and husband Tom, SM '62 (Course V), were living in Washington, D.C., where Joan worked at the National Science Foundation for two years. Before that they were in Fairbanks, Alaska, where Joan was doing research at the University of Alaska. Joan got a PhD in mechanical engineering at UC/Berkeley in 1979. Their son Paul graduated from medical school at the University of Washington this year (spring 1994). Son Mark finished a PhD in molecular biology at the University of Wisconsin/Madison, in 1992; son Eric is working on a PhD in physiology at Wisconsin, and son John is at UW/Seattle, in the PhD program in molecular biology. Son John has the distinction of being the first full second-generation researcher to work in Antarctica (Tom and Joan were there in 1979 and 1980, respectively). I can truly understand why Joan and Tom are so proud of their offspring. Mary and I hope to visit with Joan and Tom this winter, when I will visit CSM as part of my sabbatical program. I will be giving some seminars and meeting with faculty colleagues and students in the Department of Mineral Economics at CSM in February and March, 1995. (Not a bad time to visit Golden, Colo., if you like to snow ski!)

If you have access to the Internet, please send your personal news to: <mit1962@mitvma.mit.edu>. Alternatively, you can send a message directly to

me at: <uabnm01@asncube.asc.edu>. Otherwise, please send your news and personal notes to: Hank McCarl, secretary, P. O. Box 352, Birmingham, AL 35201-0352

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Please send news for this column to: Shoel M. Cohen, secretary, Dept. of Psychology, Nassau Community College, Garden City, NY 11530, or e-mail: Internet

<71271.2627@compuserve.com> or Compuserve <71271,2627>, or home phone (516) 489-6465

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I have been authorized to speak for all participants at our recent 30th Reunion—we missed all of you who could not attend! Thanks to the hard work of our Reunion

Committee, a great time was had by all. At the Class of '64 cocktail party held at the MIT Museum, we had a chance to view the campus police car, which had recently been rescued from the Great Dome. I urge all to visit the museum to see it and other notable Tech artifacts. I have also been passed this "opportunity" to be secretary by Joe Kasper, our able secretary for the last 10 years. He deserves our thanks for his hard work on our behalf. Joe was recently involved in one of life's pinnacle events—a daughter's wedding.

Among those attending the reunion were Bob Hill, wife Linda, and youngest daughter Lianne. Five years ago, after spending 22 years

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October 6-8, 1994

SPECIAL GUESTS

The Honorable William J. Crowe, Jr.
United States Ambassador to the United Kingdom
Former Chairman, Joint Chiefs of Staff

Dr. Glen L. Urban
Dean
MIT Sloan School of Management

FACULTY SPEAKERS

Dr. Nathalie E. Dierkens PhD '88
Professor of Finance, Groupe Ecole Supérieure de Commerce de Paris

Dr. Rudiger W. Dornbusch
Ford International Professor of Economics, MIT

Dr. Paul M. Healy
NTU Professor of Management, MIT Sloan School of Management

Dr. Richard L. Schmalensee SB '65 PhD '70
Professor of Economics, MIT Sloan School of Management

Dr. John M. Stopford SM '62
Professor of International Business, London Business School

INDUSTRY SPEAKERS

Mr. Johannes J. Baumhardt
Corporate Director of Quality Strategy & Assurance, Volkswagen

Mr. Robert B. Horton SL '71
Chairman, Railtrack; Former Chairman, British Petroleum

Mr. Alessandro Ovi SM '71
Senior Vice President, International Affairs, IRI

Mr. Gérard Pédraglio SM '59
Vice Chairman and CEO, Publicis•FCB Europe

Dr. Craig S. Tedmon SB '61 SM '62 PhD '64
Executive Vice President, ABB Asea Brown Boveri, Ltd.

For more information, please contact the MIT Sloan School of Management, Office of Alumni Relations by phone at 617-253-1557 or by fax at 617-253-2030.

with Hughes Aircraft Co., Bob left Los Angeles for the suburbs (i.e., Vancouver, Wash., which is across the river from Portland, Ore.). Bob is general manager of Union Carbide's Crystal Products Business. He reports that after decades of operating in the red, the business is making money again. Profitability has come simultaneously with the transition from being primarily a Department of Defense supplier to becoming a commercially focused manufacturer of high-performance electronic substrates and lan materials. After graduating from UCLA, Bob's oldest daughter, Lynette, has migrated to Colorado to be a ski instructor. His wife was a human resource specialist at Hughes and is currently enjoying semi-retirement as a student—golf, skiing, and German.

Leopoldo Guinard Baldo and wife Rosita traveled from Venezuela to attend the reunion. For seven years after graduation, Leopoldo was an electrical project engineer for the largest brewer in Venezuela. Since 1971, he has worked at an engineering, architecture, and consulting company, where he is currently vice-president. Leopoldo and Rosita have three sons: Leopoldo (25), the oldest, graduated last October as a computer science engineer and was married recently in January. Alejandro (22) is working hard in medical school, and Frederico (19) is in his second year of dental school. Leopoldo reports that he regularly attends the MIT Club of Venezuela in Caracas, where alumni/ae meet to remember good old times at Tech.

Dave Saul is currently at State Street Bank in Boston. He requested that everyone include an e-mail address with their news to this column.

This concludes all the news that Joe left me—please send more.—Bill Ribich, secretary, 18 Revere St., Lexington, MA 02173, (617) 862-3617

65 30th Reunion

Walter Miller writes of his stress at turning 50 as a Geriatric Parent. Walt's daughter,

Samantha, will be 9 in December and Nathaniel is only 5. Walt continues to be a professor of pediatrics at UC/SF. In 1993, Walt received the Clinical Endocrinology Trust Medal from the British Endocrine Society and the Henning Anderson Prize from the European Society for Pediatric Endocrinology. He recently completed a major research program to characterize Tenascin-X, an extracellular matrix protein.

I enjoyed catching up with Joel Rogers, who is a senior research scientist at the University of British Columbia. Joel likes to describe himself as an inventor, now working on his fourth major patent, a new camera for PET scanning systems to improve resolution and reduce systems cost. He has two sons by his first marriage, both in college, and a 12-year-old by his second marriage (and is now in his third!). He recently has taken the older boys to Central America and Africa.

Joel told me that Billy Roeseler had gone back to Seattle and rejoined Boeing. Billy turned over Kiteski to his son, Cory (now 24), and a group at Wichita State University that is trying to improve the foil system and kite stability.

John Kassakian was elected to the National

Academy of Engineering recently. John is a professor of electrical engineering and director of MIT's Laboratory for Electromagnetic and Electronic Systems.

I enjoyed a recent article from Regina Herzlinger where she advocates a consumer choice structure for our health care system rather than a managed care system. She points out rightly that the market system always works best when the buyers and sellers talk with each other!

Greg Johnson continues as a general partner at Gateway Associates in St. Louis. After a stint in the Army and a doctorate in physics from Rochester, Greg worked in research at Monsanto after graduating, moved into business development and corporate finance, and then went to Europe to set up a European venture capital operation for them in the early '80s. He managed Monsanto's venture operations until the mid-'80s and then joined Gateway. Greg has two children in school, one at Georgetown (law) and the other at Middlebury.

No more do I write a column than the facts change. Neil Lupton has now joined me in Gel Sciences as VP for technology. He continues to dabble on the side in his T-stick program, but now there are two of us who will talk about the wonders of phase-transition gels! We recently funded an affiliated company, Gel Med, to focus on medical products applications. . . . Art Bushkin has left Bell Atlantic Video to move back into a more entrepreneurial structure.

As I write this, Marie and I are anxiously awaiting the arrival of Jameson Gluyas, our first grandson, who is due July 14.

Write when you can.—George McKinney, 33 Old Orchard Rd., Chestnut Hill, MA 02167. 617-232-4710; e-mail: <gels@world.std.com>

Received a long letter from Mel Garelick. He and his wife, Jacqueline, have lived in Trumbull, Conn., since 1980. While there Mel finished a PhD in mechanical engineering at Yale and has been on the faculty at both Worcester Polytech and the U.S. Merchant Marine Academy. The Garelicks have three children: Adam is a ninth grader at Hopkins School, Rachel is a student at Brandeis, and Joanna is a member of the MIT class of '98. . . . Gary Schlieckert writes that he and his wife, Mary, have just returned from a Hawaiian trip in celebration of their 25th wedding anniversary. They have been living in Minnesota for about nine years. Their daughter, Rebecca, is at Princeton and son, Christopher, is finishing seventh grade. Gary still works for Alliant Techsystems and often sees classmate Curt Hedman.

According to the *Congressional Quarterly Weekly Report*, David Vanderscoff withdrew from the race for the U.S. Senate seat from North Dakota when the Republican party voted 2 to 1 to endorse his opponent, Dr. Ben Clayburgh. . . . Craig Fields has resigned from his position as chairman and CEO of Microelectronics Computer Corp. That's it for this month. It's time to write about your summer vacations again.—Eleanore Klepser, secretary, 84 Northledge Dr., Snyder, NY 14226-4056; e-mail: <vsmist66@ubvms.cc.buffalo.edu>

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Dave Schramm was recently elected a Fellow of the American Academy of Arts and Sciences. He is currently chairman of the board on physics and astronomy of the National

Research Council as well as the board of the Aspen Center for Physics. He is also a member of the Board of overseers of the Fermi National Accelerator Lab. . . . Robert Sarly has been promoted to senior VP at Smith Barney Shearson in Waltham, Mass., where he continues as senior portfolio manager. . . . Also working in Waltham is Jeff Stamen, who is director and group president of Information Resources Inc. . . . Lutz Henckels has been named to the board of directors of IKOS Systems Inc., a manufacturer of high performance, mixed-level simulation tools for top-down design of integrated circuits. IKOS Systems is located in Cupertino, Calif. Lutz is president and CEO of LeCroy Corp. in Chestnut Ridge, N.Y.—Charlotte and Jim Swanson, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024; <jswanson@lat.com>

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Not much news this month as we write in the summer doldrums. However, we received our first e-mail news from Charlotte Babicki

(babicki@gov.nt.ca) in far-off

Yellowknife, N.W.T. The public part of the message is as follows: "So welcome to the Internet world. I've only been here since April, but I have eight names on my personal Charlotte's Web, mostly MIT people. Heard from Sue Weiss Leibman a couple of weeks ago. Linda Stutte found her for me." We hope this starts a trend of high-tech communication of class news. . . . Using a lower-tech medium, Rick Adelstein writes that he is spending this school year as a visiting member of the School of Social Science at the Institute for Advanced Study in Princeton. He's on sabbatical from Wesleyan University where he has taught economics since 1975. . . . That's all we have. Look forward to hearing from you.—Gail (ghm@nrc.gov) and Mike (mmarcus@fcc.gov) Marcus, 8026 Cypress Grove Ln., Cabin John, MD 20818

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We have received the sad, belated news that Kalju Laanemets was killed in an automobile accident in January 1992. Kalju is listed as having received an SB in

Course XV and was living in Canada, where he worked as a financial analyst.

Alan Slobodnik officially joined his wife's organizational consulting firm, Options, Inc., of Reading, Mass. Alan writes that the firm specializes in "human systems implementation strategies of process engineering." . . . Russell J. Apfel and his wife, Maria, have three children: Abraham (7), Miranda (3), and Gabriel (1). After 16 years in Silicon Valley and several years of traveling, they settled in Austin,

Texas, where Russ has a consulting business designing and developing integrated circuits for the telecommunications industry. They "welcome visits from old friends who are visiting Austin."

Ed Jernigan continues at the University of Waterloo, Dept. of System Design Engineering. Ed was the recipient of the Distinguished Teacher Award and is also director of engineering admissions. He and his wife, Kim, have three children. Amanda (15) is off to Thailand on an exchange program; then there are Carey, 12, and Ethan, 7. Wife Kim is in the middle of getting a PhD in English. She also edits *The New Quarterly*, a Canadian literary magazine.

George L. Claffen, Jr., is teaching architecture at Temple University where he is a full professor. He has just completed one of the first EPA Public Environmental Education Centers for Region 3 in Philadelphia. He designed both the space and the exhibit. . . . **Paul Beckerman** has been in New Delhi, India, with his family since October 1992. Paul is there with the World Bank's Resident Mission. He writes, "This is a huge, endlessly fascinating, exotic, and astonishing country!"

In late May I was on *Good Morning America* with ABC science reporter Dr. Michael Guillen to talk about cold fusion and *Cold Fusion* magazine.

Now onto our 25th Reunion report. It was attended by some 120 classmates, plus spouses, children, and significant others. Each classmate who came was privileged to receive a 10 oz. 25th Reunion Brass Rat, with "69" on a side (but not in the twigs!). We also received our Class of 1969 25th Reunion Yearbook: 309 pages chock-full of information about the careers, families, and philosophies of classmates as they have evolved since we first met in 1965. More on that later. . . .

Memorable were Tech Night at the Pops, the panoramic class photo taken on Friday afternoon on the steps of Kresge, the class dinner at the Great Hall in Fanueil Hall Marketplace, and the Saturday night harbor cruise aboard a luxurious ship. Most memorable of all, in the view of many, were the Saturday morning talks by classmates in room 6-120. This was a golden opportunity to share special thoughts and interests. Several of us made video recordings of the gathering, so it might be possible for those unable to attend to recapture part of that experience.

At the Sunday brunch class officers were elected: **Tom Najarian** is now president; **Robert Wiener** stepped down from that lofty position and is now vice-president; **Jeff Lepes** will remain as treasurer; and, yes, **Gene Mallove**, is still secretary.

Ex-MIT president Paul Gray sent a letter of thanks to the Class, which I enter here per his request: "I write to express my heartfelt appreciation to the members of the Class of 1969 who, as part of their 25th Reunion Gift effort, contributed to the Paul E. Gray '54 Scholarship Fund. I felt, 25 years ago, a special relationship to the Class of 1969, inasmuch as I was a 'green Dean' when you arrived here in 1965. It is for me both a heartwarming and exciting thought that you have made it possible for there to be Paul E. Gray scholars at MIT for the indefinite future. Thank you very much. With warmest regards and best wishes—Paul E. Gray."

Now for class notes that have come in over

the transom. **Robert A. Swanson** continues as chairman of the board of Genentech, Inc. in San Francisco, but he now also holds the position of a director of the Geron Corp. of Menlo Park, Calif. . . . **Bruce Anderson** is president of Earth Day USA, deeply involved now in planning Earth Day 1995, the 25th anniversary! I recently had the pleasure of visiting his charming villa in Peterborough, N.H.—quite an idyllic spot. . . . **Bob Bressler** of Sun Microsystems, Inc. in Mountain View, Calif., writes: "After years and years building networking infrastructure, I decided to get back to where I started this adventure—network computing. I have taken the chief scientist, networking, role here at Sun, and plan to see what one can do with 100MIP workstations on 622 Mb networks. I think that it will be pretty exciting!"

For those of you who have not seen *The 25th Reunion Yearbook*, I include a potpourri of classmate responses to the "Comment on Life and the Universe" section. What follows is just a selection of remarks from the over one third of the class who responded. Enjoy!

Russ Block: "Since life's most important moments usually seem to be the least significant at the time, it's important to live each moment with that realization and to treat others with kindness, respect, and dignity." . . . **L. Braunstein**: "MIT is proof that out of seeming chaos some very positive things can happen!" . . . **David W. Brown**: "By the time we get it all figured out, it's over. So enjoy it." . . . **Dan E. Dudgeon**: "My idea of the afterlife—God hands out the answers to the 'What is Life?' quiz and you say, 'Damn, I should've got that. It's so simple.'" . . . **Charles T. Hudson**:

"Don't be glum, The World can hum, In a space, time, continuum." . . . **Walter Lehman**: "42." . . . **Steven Maser**: "For 25 years, I lived my life by the motto: 'Nothing in life is free.' The arrival of the reunion T-shirt shook me to the core of my being. I intend to recover, regroup, and begin anew. That's life." . . . **Lou Metzger**: "I've stopped filling in brown for hair color on forms, and started putting down gray, but I'm still waiting to feel all grown up." . . . **Dean Musgrave**: "Just when you master one phase of life, you're into another! Make a difference: We're leaving our money to a home for unwed fathers." . . . **Sumner C. Rosenberg**: "Make love, not war—even at our age." . . . **John R. Smith**: "Some people make it happen, some people watch it happen; and some people wonder just what happened!" . . .

Roy A. Yawn: "An optimist just hasn't studied the situation thoroughly."

Those of you who are fully electronic can reach me or submit class notes at Compuserve [76570,2270]. Via the Internet, use this form: <76570.2270@compuserve.com>. For those of you who would like a marvelous vacation and an amazing scientific experience, plan to attend the Fifth International Conference on Cold Fusion (ICCF-5), which will be held in Monte Carlo, Monaco, April 9–13, 1995. Write me for details. ICCF-6 will be in Beijing.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Anthony C. Picardi has been at International Data Corp. for the last four years, where he

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directed the Software Research Group. His group sized and forecast over 30 packaged software markets worldwide from object-oriented DBMs to accounting and network management. He specialized in applications development tools—case 4GL, 3GL, DBMs, etc. He says it's the most fun he's ever had at a job. Next year he'll be sailing his new J/80 out of Marblehead. His wife, Shirley (SM '72, PhD '76, SM '81), is still bursar at MIT and heavily involved in sewing and dress design. . . . **Jessie Heines** ran into **Willie Vicens** at UMass/Amherst, where both their sons had been accepted to go to college in the honors program. . . . **Alan Chapman** and his wife, **Karen Benjamin**, both songsters, have announced the "world premiere" of their first child, Jacob.

Observant readers will notice that in this issue our notes are preceded by the heading "25th Reunion." Several of our classmates, including **Joe Bisaccio**, **Greg Jackson**, **Bob Dennis**, **Charlie Housman**, **Laura Malin Eisenmann**, **Jill Wittels**, and **Karen Arenson** met at MIT in May to begin planning the events for June 16, 1995. Others, including **Tim Dalton**, **Pam Whitman**, **Mary Thornton**, and **George Katsiaficas**, have already agreed to help. Anyone else who is interested can contact us or Eliza Dame in the MIT alumni/ae office (phone: (617) 253-8230). Joe, our former class president, has agreed to chair the reunion, and is searching for appropriate live entertainment for a possible beer blast. Greg Jackson is coordinating a session that will review the unusual times during which we attended MIT and their impact on us. All ideas for these events and others (a reunion hack?) are welcome. Karen will also be separately asking you to recite your history since graduation for publication to all members of the class. We urge your cooperation, contributions to, and presence at the reunion.—**Greg and Karen Arenson**, co-secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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Corrections are in order: the person listed as David Wineburg is actually **Daniel Weinberg**. He faced three graduations this year—his stepson, Robert, from Syracuse University; his stepdaughter, Catherine, from high school; and his son, George, from the sixth grade. His other two sons, Garrett and Henry, will be leaving tenth and ninth grades, and both of them are now taller than he is. Daniel is now captain of the District 6 Non-Life Masters Grand National Teams Bridge Championship and will compete in San Diego. . . . **Richard Park** is now living in Palm Harbor, Fla., and working in St. Petersburg as an attorney in charge of trusts and estate administration for Northern Trust Bank in the Tampa Bay region.

Grethe B. Holby is due congratulations on the birth of her third child, Ansel Elgort. He was named after the photographer; her husband is a photographer: Arthur Elgort. She reports that American Opera Projects is

growing and her next gig is in Anchorage, Alaska, for a *Hansel and Gretel* performance. She has two other children, Sophie, 8, and Warren, 4. . . . Marc F. Roddin has just finished preparation of the airport system plan (for the next 20 years) for the nine-county region that includes San Francisco, San Jose, and Oakland. He is now getting the nine-county regional seaport plan well under way. . . . I have been involved in the formation of a new school, Brenham Christian Academy that will ultimately go from sixth through twelfth grade.—**R. Hal Moorman**, secretary, P.O. Box 1808, Brenham, TX 77834-1808

72 James L. Davis has founded a company, Gradient, Inc. Unfortunately, I have had trouble reading his printing, but I think that he wrote that the company is a systems integrator of image generation and display equipment for flight simulation and location-based entertainment. . . . **Skip Elliott** is currently the business manager for the local Catholic bishop. He has been married for five years to Sharon Fisher, a family physician and Canadian citizen. They are active runners, cross-country skiers, and bicyclists. Skip recently purchased a rowing shell and "hopes to recapture past glories." . . . A press note tells us that **Pete Sanders** is a self-styled brain researcher now living in Sedona, Ariz. He recently gave a seminar in Houston to teach people how to access the brain's "joy center," their septum pellucidum. Pete is married to a woman who teaches gifted students, and they have two children.

That's all the news for now, but I hope that I will get more news to report next time.—**Co-secretaries: Wendy Elaine Erb**, secretary, 6001 Pelican Bay Blvd., #1001, Naples, FL 33963, and **Dick Fletcher**, 135 West St., Braintree, MA 02184

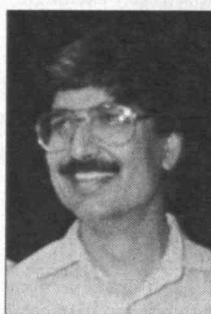
73 John Potter has left Utilix Corp. of Kent, Wash., where he was president and CEO, but no word on his current status. Hope to get more to pass on. . . . **Russell Dominique** has, incredibly, weathered six layoffs in the past three years and survived; he's "looking for a change," and who can blame him! Their daughter, Amelia, is nearly 14 now. Russ would like to hear from old Burton/McGregorians, or NOL coop folks when you're in the DC area. He's at rdominique@aol.com.

Steven Bielagus has been promoted to VP of engineering at Proteon, a LAN product and services company in Westborough, Mass. He will be responsible for directing their engineering organization in the design and management of new and existing products, particularly those related to high-performance internetworking. Steve had been most recently a member of Proteon's engineering group.

That's a wrap for this issue. Write or e-mail!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115, e-mail: sutton_bob@prc.com

74 Please send news for this column to: Class co-secretaries: **Barry Nelson**, 65 Hillside Ave., W. Newton, MA 02165-2543, and **David Withee**, 1202 Linden Dr., Mt. Pleasant, IA 52641

75 **20th Reunion**
Babar Khan has been honored by Philips Laboratories with its 1994 Technical Achievement Award. Khan was recognized for "inventing a new ultra-miniature, low-cost lighting technology called 'Micro-Lamp,'" based on semiconductor manufacturing processes. The award carries with it a cash prize of \$5,000. Khan received a PhD in Course VI in 1984.



Babar Khan

Please send news for this column to: **Jennifer Gordon**, secretary, c/o Pennie & Edmonds, 1155 Avenue of the Americas, New York, NY 10036, or 18 Montgomery Place, Brooklyn, NY 11215

76 We are in dire need of news. Please write, fax, or especially, e-mail me. We need your e-mail addresses. For those of you who have them but have not provided them to me yet, I have an incentive—you will be able to see the Notes several months before they are printed in *Technology Review*. E-mail is allowing us to stay in closer, more timely touch.

From the U.S. Postal Service, **Marsha Lavoie**, MD, writes: "Professional: employed as staff/faculty physician at Family Health and Social Service Center in Worcester, Mass., where I am involved in teaching family-practice residents. Personal: Married in February 1992 to Jonathan Logee, a self-employed metalsmith. We have a daughter, Amanda, born in December 1993, in addition to Jonathan's son, Seth, age 17, and my two sons, Jonathan, 12, and Philip, 9."

From the Internet: **Greg Allen** sent the following: "Saw in an issue of *Macworld* recently a review of a product on video editing, that can be done easily on the Mac from your own home camcorder, and noticed the company to be Abbate Video. Back at Burton House I had a friend named **Mark Abbate**, and was certain this would be he. Sure enough: I contacted him at the number given in *Macworld*, and we had a nice chat. I ordered his product and can use it to make the video scenes of my 6-year-old daughter much more bearable for the viewers of my home movies, though I still can't swear they're not bored. **Jeff Clarke**, whom I knew from '76 varsity lightweight crew, just so happens to live in Everett, Wash., with his wife and kids (he is now **Jeff Kelley-Clarke**). I ran into him by accident a

few years ago. I am in practice in Everett as a radiologist."

As for your secretary, he is recovering from a massive PC problem. In my arrogance, I did a system upgrade without doing a complete backup prior. Since I always push the edge of everything I do, I inadvertently pushed over the edge my last two months of work. So any of you who have e-mailed me from March 1 to June 15, please resend it! I have, however, learned my lesson: to backup prior to tinkering. Concerning my VAR and Integration business, Quantalytics, Inc., we have a saying that those of you who use PCs might like (or dread): "If it works, it must be obsolete."—**Arthur J. Carp**, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523; tel & fax: (516) 295-3230 (auto-switched); e-mail: cquantalt@aol.com

77 Please send news for this column to: **Ninamarie Maragioglio**, secretary P.O. Box 10315 Burke, VA 22009-0315

78 **Gene Henschel** sends us a note from Portland, Ore.: "Got together with **Carol Siegel Friefeld** and her husband **Geoff** for four days of skiing at Alta. We had a great time comparing notes on becoming physicians and various Grateful Dead concerts. Drop a line!" . . . **Janet Wiedeman** writes that she is working as a labor relations specialist for Stop & Shop Supermarket Co. in Quincy, Mass., where she recently purchased a house. . . . **Carrick Brooke-Davidson** brings us up to date on family and job news: "Daughter **Emma** was born June 23, 1993. I am senior attorney in the environment Enforcement Section, U.S. Department of Justice."

Fern Crandall DeVale sends news about the results of her pregnant state at our last reunion: "On September 1, 1993, we had a boy, Antonio Joseph DeVale III. I have happily joined the ranks of the unemployed to take care of him." Fern writes that this unemployed state was not her original intent but that she had some difficulties getting her employer to fully grant her maternity leave. Maybe she should talk to **Carrick Brooke-Davidson** about Justice Department help!

That rockin' babe **Julie Kozaczka Stahlhut** sends a long letter: "I'm finishing up an MS in biology this summer at Western Michigan University. I've been accepted into a doctoral program at Michigan State University and will begin working there on a PhD in entomology and evolutionary biology in the fall of 1994. Rick and I are having the time of our lives in Kalamazoo; we wish we'd moved to the Midwest years earlier!"

"I got involved in campus life at WMU by playing College Bowl again! You may remember that I played on the MIT quiz team in 1978. In January of 1992, as I began my first semester at Western, I read that Western was holding an intramural College Bowl tournament. I asked if a 35-year-old grad student could play, and was promptly assigned to a team. After a 14-year layoff, I expected to make it through a game or two and get eliminated. Instead, I wound up on Western's trav-

eling team. I've now played in three regional and countless invitational College Bowl tournaments, was named regional MVP in 1992, made the regional all-star team in 1993 and 1994, and was a member of the WMU team that won our College Bowl regional. We placed seventh in the 1994 College Bowl nationals, and a teammate and I both played in the national all-star game (where four of eight players were over 35!) I'm now tentatively retired from the college game, although I plan to volunteer as a moderator on the invitational circuit and maybe play as a freelancer in some open tournaments. Michigan State participates in a national entomology quiz bowl tournament, so I'm planning on going out for that team next year!" Julie, always planning ahead, hopes to see everyone at our 20th Reunion in (gulp) 1998.

Your class secretary and wife **Diane Curtis** and kids **Danielle (3)**, **Luke (2)**, and **Hannah (9 months)** traveled to Boston for a breakneck five-day visit that included relatives and clients but not much else. Our expectations for travel with the kids were quite low, so we were pleased when the trip went pretty well. We realized that we'd reached a turning point when the desirable job on the trip was driving!—**Jim Bidigare**, secretary, 9095 North St. Rd. NW, Newark, OH 43055-9538, (614) 745-2676, fax: (614) 745-5648

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Greetings from our 15th reunion! Your faithful secretary has been reelected for yet another five years, as were Class President **Bruce Bornstein**, Vice-President **Bonnie**

Mason, and Treasurer **Lisa Bendixen**. Our new Members-at-Large are **Norm Guivens**, **Ellen (Blake) Leckband**, and **Beth Marcus**. We had three class activities this time around: Friday night there was an outdoor clambake on campus; Saturday night a dinner dance in Boston's Bay Tower Room; and Sunday a brunch at the MIT Museum. The turnout was not as large as our last reunion, but I nevertheless managed to gather some good dirt. . . . **Gordon Haff** is a product manager at Data General, working with high-end Unix servers. He also owns his own company developing software for PCs. In his spare (!) time, he is a leader with the Appalachian Mountain Club. . . . **Bruce Bornstein** is a radiation oncologist at the Dana Farber Cancer Institute (one of the Harvard hospitals). He was accompanied at the reunion by his wife, **Wendy**, their 5 1/2-year-old son, and 2 1/2-year-old daughter.

Martin Aboitiz Uriarte wins the prize for furthest distance traveled. He came up from Argentina, where he recently sold his family-owned snack-food company, and he is currently scouting around for new opportunities. Martin is the father of four, ranging in age from 12 years to 8 months. . . . **Jim Lester** is practicing law in Greensboro, N.C. He consults with start-up companies on the subject of intellectual property—or, as he puts it, "roundtable research commercialization." Jim has two children, ages 10 and 6. . . . **Ron Newman** has been back at MIT since January, programming a knowledge representation system in the Media Lab. Ron's last stint at the 'Tute was four years on Project Athena starting in 1984. In 1988, he went to work at

Lotus, then in 1991 he was off to the consulting firm of BBN. Ron lives in Davis Square in Somerville. . . . **Jim Atwood** lives in Concord, Mass., with wife **Kathy** and their two children, ages 2 years and 7 months. Jim has just launched a software start-up company, developing a resource allocation package for personnel scheduling.

Evita Vulgaris lives in Chicago and works for the Cellular Business Unit of Bell Labs. She is president of the MIT Club of Chicago and is on the Educational Council as well. She was accompanied at the Reunion by **Craig Gustafson**, '78. . . . **Bennett Baker** owns a company called B::Ware, which develops software for PCs. He was at the reunion with his wife, **Rhonda Kaufman**. They live in Dedham. . . . **Norm Guivens** is working on electro-optical sensors at Sparta, an R&D company in Lexington. For the past nine summers, he has been taking courses at the St. Meinrad School of Theology in Minnesota, and recently received a master's of theological studies in pastoral ministry. Norm lives in Braintree.

Joan Sienkiewicz wins the prize for having worked at the same company ever since graduation! Her first five years with Electric Boat (a division of General Dynamics) were up in Groton, Conn. The middle five years were spent working in Crystal City, Va., right outside of D.C. Then it was back to Connecticut for the most recent five. She is currently living in Pawcatuck, Conn., just 10 miles away from Foxwoods, the Indian Reservation turned gambling casino. . . . Rumor has it that **Lisa Bendixen** has also spent the last 15 years at one company, **Arthur D. Little**, but since Lisa managed to sneak away without ever talking to me, I can neither confirm nor deny these rumors. Lisa, drop me a line and fill me in! . . . **Stephen Estes-Smargiassi** is the manager of planning for the Waterworks Division of the Massachusetts Water Resources Authority. He makes his home in Jamaica Plain with his wife, **Beverly**, and their two children, ages 4 years and 2 months. . . . **Bonnie Mason** showed up at the brunch without her husband, **Al Chock**, '78, who was in a walkathon that day, but she did come with pictures of 4-year-old son **Alfred**. Bonnie has been with **Wang in Lowell, Mass.**, for the last 11 years. She commutes all the way from **Newton, N.H.** . . . **Rick Kovalcik**, our class agent, was ubiquitous at the reunion with his wife, **Susan Mozzicato**.

Craig Leckband, '80, and **Ellen (Blake) Leckband** are both in the computer field: he works in object-oriented databases for Ontos, Inc., and she works for Hewlett-Packard in the medical products area. The Leckbands live in Bedford, Mass., with their two sons, ages 9 and 5. Craig expressed an interest in reviving his erstwhile pastime of ballroom dancing. . . . Speaking of ballroom dancing, **Dan Radler** (who was not at the reunion) has been competing professionally in ballroom dance competitions. Dan, please write with more details. . . . **Ed Hunter** lives in Santa Clara, Calif., and works for Sun Microsystems. He has not lost his interest in the theatre, and works frequently backstage on local productions as well as on the volunteer crew for his local PBS station. He spends the rest of his spare time motorcycling or flying (he has a pilot's license). . . . Another classmate with a pilot's license is **Kwan Kwok**, who is also into skiing, bicy-

ClassNotes

cling, running, astronomy, tennis, motorcycling, sky diving, scuba diving, and professional race car driving! **Kwan** lives in Albuquerque, N.M., and works for Sandia National Labs as a control systems specialist in robotics. He had previously been employed by MIT.

Glen Langston wins the prize for the longest drive to reach the reunion. Glen and his wife, **Katherine**, drove 14 hours from Greenbank, W.V., where he works at the National Radio Astronomy Observatory. Glen got a PhD at MIT in 1987. The Langstons have two children, ages 3 1/2 and 9 months. Glen also wins the prize for the greatest distance traveled AFTER the reunion: he was flying to Moscow that night on business! . . . **John Hopper** lives in Pepperell, Mass., and works in Waltham as a database technology consultant for IRI Software. In addition to being the father of 6-year-old twin girls, John is a mountain climber who has been to the top of Mt. Washington, as well as Mt. Whitney and Mt. Shasta in Yosemite. John recently attended the Indianapolis 500 as a spectator. . . . Speaking of racing, **Beth Marcus** is a race car driver at the professional level! She is also the founder of Exos, a company based in Lexington, Mass., which produces the devices that make virtual reality possible—as she described it, "bringing touch feedback to entertainment." She was recently featured in *Working Woman Magazine's* spread on the 10 best cities for women entrepreneurs (if you run into Beth, ask her to tell you about being photographed for the article on the Longfellow Bridge!) Beth is an active participant in the MIT Enterprise Forum, which provides a network for entrepreneurs. . . . **Jay Erickson** is a hand surgeon with his own practice in Winchester, Mass. He is board-certified in both orthopedics and hand surgery, and is a member of the American College of Surgeons, the American Academy of Orthopedists, and the American Society for Surgery of the Hand. Some recent trips have found him windsurfing off the coast of Venezuela, and helicopter-skiing in British Columbia.

Thanks to some friends with loose lips, I have some dirt on classmates who did not come to the reunion. **Steve Meretzky** and some other MIT alums recently founded Bof-fo Games, developing computer games software. . . . **Sam Singer** is a surgical oncologist at Peter Bent Brigham Hospital in Boston, doing research in MRI. . . . In a similar vein, **Warren Manning** is a cardiologist who works with MRI at Beth Israel Hospital in Boston. He recently had two articles published in the *New England Journal of Medicine*. . . . **Gregg Stave**, who is a doctor AND a lawyer, works in occupational medicine for Glaxo Pharmaceuticals in North Carolina. He has a daughter. . . . **Patrice (Tyrrell) Koch** was married in May 1991 and works in chemistry in Los Altos, Calif. . . . **Suzanne Burzyk** still works for Polaroid. Husband **Dave Boccuti** is with Northrop. They live in Wellesley. . . . I guess that's all. If you missed the reunion and have friends who keep your secrets (or if you attended the reunion but somehow managed

to avoid me!), then drop me a line to let all your classmates know how you've spent the last five years. Until next time—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

80 15th Reunion

Congratulations: Long Tran has completed an MBA degree with honors, December 1993, at the University of Louisville. This past April he was inducted into Beta Gamma Sigma, the national honor society for academic excellence in business administration. Long is currently working at General Electric Co. By the time you read this Long and his wife should be celebrating the birth of their first child. In his letter, Long writes that during his newfound spare time (that may not last after the arrival of their baby!) he volunteers as a monitor/reader for the Recording for the Blind, Inc., and also as a fund-raiser for the Dream Factory, Inc., a national not-for-profit organization that fulfills the dreams of critically ill or chronically ill children. Thanks for the letter and don't forget to let us know about your baby! ... A news release from Tenneco, Inc., announced that **Joseph Broz**, currently director of environmental and technical services, will become executive director of operations and quality systems. Prior to joining Tenneco Gas in 1992, Joseph was a White House Fellow serving as the special assistant to the science and technology advisor to the President. He has published numerous technical papers and economic studies and holds a U.S. patent for an environmental safety illumination system. His operating methods for enhanced oil recovery are the subject of five U.S. patent applications.

Enjoying the scenery: Josh Herz says he is still enjoying the dramatic upstate New York changes of seasons five years after returning to his hometown of Rochester. Daughters Beth (10) and Nomi (7) are helping him to keep his priorities straight and "spousal unit" Ruth Fried is pleased with her new occupational therapy job at the local medical center. ... **Martin Prince** has moved to my part of the woods—he has begun working as co-director of MRI at the University of Michigan. He says it is beautiful here. ... "Hello and Best Wishes to Everyone" from **Gene Suk-Jin Han**. Gene has finally settled down with his wife and two children: Phillip (4) and Michael (2). He enjoys living and working in Los Angeles—sunny and full of excitement. ... **Arthur Aaron** and his wife, Patti, are now living in Maryland with their three children: 6-year-old twins, Chelsea and Amelia, and 3-year-old Madeleine. Arthur left the Boston office of Skadden, Arps, Slate, Meagher, and Flom in July 1993 to take an in-house legal position at COMSAT Corp. in Bethesda. He says if he has to work on legal documents it makes a fun twist that they often refer to satellites and spacecraft.

Recruiting: The Class of 1980 is looking for a few good men and women to serve as class officers for 1995–2000! At our class reunion next June we will be electing a new president, VP/treasurer, secretary, and three members-at-large. In addition to these elected positions there are other opportunities to serve our

class. If you are interested please let me know. You do not have to live in the Boston area or be present at the reunion to be elected and serve.

Condolence: I have received notice of the death of **Charles Hogg** on December 14, 1993. No other information was provided. Our condolences to his family and friends.

Technology Review is always looking for good quality photos of alumni/ae highlighting their activities for publication in the Class-notes section. Let's add some interest to our notes—send your photos along with your news to: **Kim Zaugg**, secretary, 549 Fairfield Rd., Canton, MI 48188, (313)981-1785; <vayda@erim.org>

81

The usual flood of news reports to this column has slowed to a trickle lately. Come on, people! We know you're doing something, so why not let us in on it?

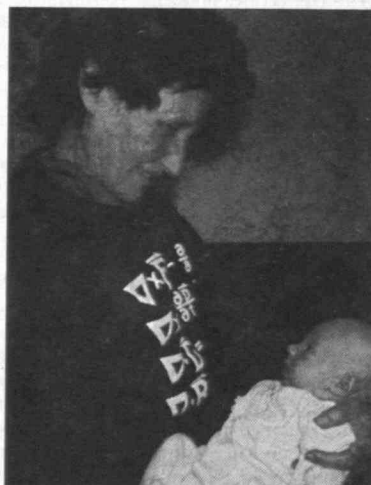
From the Pacific . . . Last

time we heard from **Debye Meadows Galaska**, she was in the Air Force stationed on Okinawa as a bioenvironmental engineer, and was enjoying life with husband and five children. Debye has informed us that she was expecting her fifth child this past May (I guess that makes six altogether, right Debye?). She was expecting to be transferred to a new station this summer.

. . . To the Lone Star State: **Richard Tucker** has moved to Dallas, where he has opened his own company, Texas Asset Investments, Inc. Richard's new operation undertakes real estate development and investments in the commercial and residential sectors.

Shell Game: **Thomas Semple** is still doing chemistry for Shell Oil, where he has been working on a team which developed Formula Shell gasolines. Thomas' daughter Alana is now one year old, and he's expecting a second child as of this past summer. As a result, the annual summer trek to the Cape will probably turn into an autumn trek to see the leaves turn when #2 is old enough to fly.

Two for One: This column has its first pho-



Andrea, daughter of Claudia Buser and John Keklak, both '81, reviews Maxwell's equations on her grandmother's sweatshirt.

to, courtesy of **Claudia Buser** and **John Keklak**. Last October, Claudia and John were blessed with their first child, **Andrea Claudia Maria**. As you will note, little Andrea is already showing signs of being MIT material—at two weeks, she was already studying Maxwell's equations, as presented by her maternal grandmother, the renowned New Jersey physicist Dr. Waltraut Buser. Just as I always thought—E&M really is child's play! The proud couple further report that Claudia finished a PhD at the Institute in 1992 in the (now defunct) Department of Applied Biological Sciences, and now has a position as associate scientist at Repligen Corp. John has been running a small company, Building Block Software, which produces software development kits for CAD/CAM. Claudia and John occasionally see **Amy Luttinger**, who has indicated that she may have interesting news for us in the near future (hint, hint, Amy). Thanks for the update and the picture, Claudia and John.—**Mike Gerardi**, secretary, 3372 Olive St., Huntington Park, CA 90255, (213) 587-2929 (h), (310) 553-5050 (w)

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John Allred writes that he is currently a senior engineer and corporate pilot at Stratos Product Development Group, a small, multi-disciplinary engineering firm in Seattle.

They've designed things as small as pointing devices for Apple and Microsoft to 30,000-pound computer-controlled rug looms. **Milton Sigelmann**, '80, is also here. Before that, he spent five years at Bolt Beranek and Newman working on the world's largest distributed video game, SIMNET, a training environment for pilots and tank crews. **Carol Chiang** and **Duncan Miller**, '64, also worked on SIMNET.

John and his wife, Anna, recently bought a wonderful house on a mountaintop near Seattle. Other occupants of the house include two dogs (a Newfie/Labrador-retriever puppy and a Shepherd/Collie mix, both big dogs) and two cats, which makes for an interesting home.

William Schwartz says that construction is picking up in the Philly area. He is celebrating Intech's 10th year anniversary in 1995. His kids, Ali (2³/₄) and Drew (1¹/₄) are ready for the summer at the Jersey Shore!

John Canning joined the faculty of the School of Computer Science at the University of Oklahoma in January. He really enjoys teaching and says that it feels very different being on the other side of the podium. His son, Jamison, was born last October and keeps his wife, June, and him very busy.—**Helen (Fray) Fanucci**, secretary, 502 Valley Forge Way, Campbell, CA 95008; email: <fan-group@aol.com>

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Steve Yoon and his wife, Paula, have just moved to Norcross, Ga. Steve was recently in Egypt where he was in charge of a U.S. AID-sponsored project for setting

up a geographic information system to monitor Egypt's schistosomiasis control program. Steve is working with the Egyptian Ministry of Health to control the parasite. ... **Bob Grimes** held a housewarming party at his new house in South Natick, Mass. The party was also

attended by **Javier de Luis**. Both Bob and Javier work at Payload Systems in Cambridge.

I ran into **Adrian Yovanovich** at a recent party. Adrian and his fiancée, Miriam Maxxim, had just returned from one of those pre-wedding, weekend counseling courses. Miriam passed the course easily. Adrian also passed but only after taking the tutored test three times.

Since no one sent in any information this month, I shall amuse and abuse you with some random selections from the MIT class directory. All I can say about the following statements is that each was at least once true:

Gregory Abbas is a scientist at Boeing Electronics in Seattle. . . . **Carl Feynman** is a design engineer at Thinking Machines Corp. Carl was interviewed on public television recently for a Nova documentary on his father, Richard, the Nobel Prize winning physicist (and author of one of my favorite books, *Surely You're Joking, Mr. Feynman!*). . . . **Martin Kannengieser** is VP at Bankers Trust Co. in New York. . . . **Jennifer Melcher** is a post-doctoral fellow at Mass. Eye and Ear Infirmary. . . . **Betsy Pollack** is a software engineer at ITP Systems in Cambridge, Mass. . . . and **Bonnie Sullivan** is managing partner at Pacifitech West Ltd. in San Francisco.

How about some cards and letters?—

Jonathan Goldstein, secretary, c/o TA Associates, High Street Tower, 125 High St., Suite 2500, Boston, MA 02110, fax: (617) 574-6728

84

Well, hello everyone! This is your new secretary speaking. I thought I'd start off my first column by listing the survivors of the fiercely contested elections for Officers of

the Class of 1984. They are: **Natalie Lorenz**, president; **Diane Petersen**, vice-president; **Mark DeCew**, treasurer; **Jonathan Miller**, secretary; **Sandra Thomas**, correspondence secretary; and **Howard Reubenstein**, class agent. Special thanks go to **Sarah Tabler**, whose tremendous efforts made our 10th reunion an incredibly fun time! It was great to see everyone there.

Of course, no visit to MIT is complete without some element of hacking, so at the end of Sunday Brunch the newly elected officers had photos taken on the roof of [this section deleted to protect the names of the guilty].

Now, anyone who knows Mark knows that by putting him in office, we have made not just a decision on an officer but, more importantly, a lifestyle choice! The class of 1984 is now determined to make the next five years, including any and all reunions between now and 1999, the most memorable and notorious ever. Mark, by the way, has just completed his biggest film accomplishment to date, *The Restoration of a Renaissance Altarpiece*, a 30-minute documentary about the story and science behind the restoration of an ancient religious artwork. "I chose the name to assist researchers. The title has all the important keywords needed for a computer search," said Mark. Congratulations on this major accomplishment!

OK, enough about the grease. **Vincent Palermo** writes in to say, "Vtech Engineering Corp., an electronics development company that I started seven years ago, has expanded to

a new location in Acton, Mass. Patrick Cobler, '88, SM '90, a fellow EE alumnus, has joined on as a senior partner." . . . And **Chris Petti** says, "I received a PhD in EE from Stanford in 1989 and have been working at Cypress Semiconductor in San Jose since. I've been married since 1992, and my wife, Judy, and I just bought a house in Mountain View, Calif."

Karen Caswelch tells us, "After 10 years of calling Warren, Ohio, home, I've been transferred to Detroit. My husband, Tom, our daughter, Kristine, and I are getting used to living in the 'Big City.' Kristine turned 1 on April 8—things are obviously hectic for us." . . . **Ron Reade** received a PhD in materials science and engineering from UC/Berkeley in November 1993 ("Finally!") and is now working as a post doc at Lawrence Berkeley Laboratory. . . . "I am a proud father of a 2-year-old girl named Brianna Elizabeth," writes **Roy Turnbull**. "I am a senior project engineer at TRW Vehicle Safety Systems, responsible for performance of airbag systems in passenger vehicles. It's amazing how fast time goes by—it's hard to believe I've been married almost seven years and my baby girl is already 2. She says, 'I'm no baby!' and she isn't; she's a beautiful little girl."

I just got some e-mail from **Gerry Smith**, who now lives in Boulder, Colo. He says, "We are having record high temperatures here, and my garden is starting to fry. I water it every day, but that is barely enough. All my crops are legal this year: beans, tomatoes, potatoes, cucumbers, snow peas, melons, lettuce, peppers, jalapeños, aphids, etc. I don't even like veggies that much, unless in a good Chinese sauce. Gardening is very therapeutic, and keeps me out of the bars."

Speaking of the Internet: Send me e-mail with your address and an update on what's happening in your neck of the woods (or coax, whatever). I'll publish these notes as a newsletter distributed electronically to everyone as well as submitting them to *Tech Review*.

Note: The Class of 1984 published a *10th Reunion Yearbook*. If you want a copy, please

ClassNotes

contact Susan Tomases at the Alumni/ae Office at (617) 253-8216.—**Jonathan Miller**, secretary, 78 Roosevelt Circle, Palo Alto, CA 94306, tel: (415) 494-7430, fax: (415) 813-1130; <jonathan_miller@logitech.com>

85

10th Reunion

Greetings all. The big news is that supercomputer genius **Gary Sabot** married Jennifer

Wade, '87, on April 30. The wedding was preceded by a paintball bachelor party in which this reporter was grievously wounded many times. Attending the wedding were **Dave Sherman**, **Jim Hutchinson**, **Andy Renshaw**, **Marty Rauchwerk**, **Anne Fricker**, '86, **Amy Austin**, '87, and **Nancy Defeo**, '84. The orgasmic food led the MIT crowd to shut down both the reception and the brunch on the following day. Unconfirmed reports from the wedding indicate that a large number of Harvard dinner-table defectors admitted that the MIT table was more fun. Cumberbunds were found around people's heads later in the evening, but skirts were definitely not worn by the men at any time.

Ondria Jaffe Wasem is still working in applied research at Bellcore. This year she was one of four people on the Bellcore team, that was itself among the six competing for the prestigious Edelman Prize in Operations Research and Management Science. They didn't win, but put on quite a show at the competition on April 24 in Boston. She and her husband, Peter, are putting the finishing touches on their first house and their first child. She thinks that the baby is going to beat the house.

Carl Pietrzak writes: "I'm reconnected to



Class of '84 Officers, l to r above: Steve Slivan, Sarah Tabler, Natalie Lorenz, Jonathan Miller, Diane Peterson, Mark DeCew, Howard Reubenstein, and Sandra Thomas. At left: same lineup of suspects in "secret" hack location.



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—ESTABLISHED IN 1978—

the Internet finally. Just returned to work from a three-week holiday in the Seychelles and Mauritius. I've been in Moscow for the past year as operations manager for Motorola, Russia. Built cellular phone systems in Moscow and Nizhny Novgorod. Saw the action last October firsthand (but I was not one of those twits on the bridge with the tanks!). Life in Russia is physically hard, but never, ever boring! Plan to be here for another one-to-three years. Cyberspace home is <carlp@glas.apc.org>. Towards [Bill's] research funding, I pledge a year of free cell-phone calls in Chelyabinsk. (I can also provide leads on missile launchers, plutonium, etc.)" . . . Also from our foreign service desk, Joe Hammer is returning to live in Manhattan after four-and-a-half years in Japan. He is still working for Morgan Stanley.

Stephanie Winner says that she and Jeff had their third daughter, Haley Anne, on May 5 weighing in at a significant 8 lbs. 7 oz. Last May Jeff joined a start-up, Collabra, as a founder. Stephanie is taking her long-overdue sabbatical from Apple, and will be returning to continue working on ASICs for 3D graphics. As far as other classmates, the Winners spent a day at the Oakland Zoo with Anna Lisa Fear and her husband, John Goodwin. Also Stephanie visited Libby Patterson at her new house in Saratoga, Calif., and met her daughter, Frances, who is a week older than Haley.

Kim Fradd Saxton just finished the second year of a PhD in marketing and strategic management at Indiana University. Having completed her course work, she is now going full steam ahead on her dissertation topic on the role of marketing in creating organization adaptability. She received a best paper award at a national conference for the conceptual paper that she wrote on the topic. Husband Todd Saxton is collecting data for his dissertation on factors leading to successful acquisitions and joint ventures. In baby-making news, Kim had her second daughter, Mackensey, on June 2. Mackensey, at 9 lbs. 0 oz., was a bit of a respite from the first, Lindsey, who weighed 9 lbs. 14 oz. (Ouch!) Having two children and PhD work is not enough to keep Kim and Todd busy, so they also have a freelance strategic planning consulting firm they started about three years ago called The Barnegat Group.

Send news to Bill Messner, secretary, Plutonium and Missile Launcher Research Department, Carnegie Mellon University, 5927 Alder St., Pittsburgh, PA 15232, (412) 361-4180; Internet: <bmessner@andrew.cmu.edu>; List-server: <mit1985@mitvma.mit.edu>

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Greetings! Sorry I missed last month. The baby keeps me pretty busy so I've decided to resign and let someone else have a shot at this. It's been fun.

Rich Maurer called me from beautiful Grand Forks, N.D. He is a B-1 aircraft commander and should, by now, be at Dyess AFB in Abilene, Tex. (Of course, Abilene was the only place out of range of my pager when I drove across the country). He's also engaged to be married. . . . Gina Buccellato dropped me a note to say that she and husband, Mike Supina, '85, had a baby daughter, Mariet

Josephine on March 23, 1994. Gina will be returning back to work at 3M in St. Paul, Minn., in July.

Erica Shane, since getting a PhD in chemical engineering from Carnegie Mellon (Dec. 1991), has worked at a large pharmaceutical company (American Cyanamid) for one-and-a-half years; DNX, a small biotech company for six months; unemployed for four months, and now works for MedImmune Inc., another start-up biotech company. . . . Richard Rusin moved to Minnesota in 1992 and is working in the Dental Products Division at 3M. His son, Daniel Richard, was born in December 1993.

Robert Lenoil will be getting married this August. Business is picking up for Catalogic, his CD-ROM service business (and he's looking to hire staff). He went backpacking in Big Sur in early May 1994 with the MIT Alumni/ae Club of Northern California. He reports the 10-mile hike was a good warmup for the Bay-to-Breakers road race. (My husband and I ran the 1990 race—what fun!)

David Milli has been working overseas in Moldova for Price Waterhouse's International Privatization Group since December 1993. Moldova is a former Soviet republic near the Black Sea. David's there to assist the Moldovan government with initial privatization efforts and capital market reforms. His job is to manage the information technology team and to help establish the first Moldovan stock exchange. He should be there through the end of 1994. He can be reached via e-mail at <dmmilli@pwh.moldova>.

Greg Harrison has been at JPL in Pasadena, Calif., for just over two years. He's a Technical Group leader working on the attitude control for the Galileo spacecraft. Galileo is due to rendezvous with Jupiter in December 1995. Greg purchased his first home last fall in Altadena, Calif. Altadena used to be a quiet neighborhood but Greg has since survived the big earthquake, fires, and floods. Greg's still involved with comedy and has joined a group called The Legitimate Freaks. Look for Greg in the "released straight to video" movie called *Dangerous Diversions*. He also auditioned for the Groundlings (whatever they are) and got in. Congratulations, I think. Greg occasionally sees John Rulnick and Ray Covert. John is working hard on a PhD at UCLA. Apparently, John loves Mexican food and spends a lot of time at his two favorite restaurants, Lares and Talpa. Ray is working at Tecolote in Manhattan Beach, Calif. He and his wife, Amea, are expecting their first baby.

I'd like to correct another faux pas on my part. Not being an expert in Asian names, I incorrectly assumed that Yong Hahn was a woman. He called to let me know that no, he did not have a sex change and was still a man. My mistake. Sorry!

Anne Fricker and Jim Hutchinson, '85, are coming down to visit us this weekend. They (finally!) announced their engagement and will be getting married in September in Maine. Ellen Epstein and Ray Brunsberg were also supposed to come but Ellen is in big demand at Morgan Stanley and had to go to Atlanta for the weekend. Ellen and Ray also recently announced their engagement (no date yet). Karen (Wohl) Schmitt and Ray Schmitt also came to visit in lieu of their trip to Turkey. Boy, do we rate!

In addition to resigning from this august

post, I put in my papers to get out of the Air Force. I waited them out long enough so that they finally offered me money to leave. (Ha! to you guys who jumped ship early with no compensation.) I will get a nice stipend annually for the next 16 years. It will help out nicely in preparing for Jerad's college education (and his little brother or sister). Yep, we're expecting again. Due date is December 17, 1994. Another tax deduction.

Bill Hobbis has volunteered to be Class of '86 secretary. Write to him at: 5 Cappy Cir., W. Newton, 02165, or e-mail: <william_hobbis@cognex.com>.—**Mary C. Engebret**, secretary, 21305 Arrowhead Ct., Ashburn, VA 22011, (703) 729-6568

87

As promised last month, I will begin with a synopsis of the wedding of our Class President, **Stephanie Levin**, and our Class Agent, **Jim Koenig**, who celebrated their first anniversary this past May 30th. This account was e-mailed to me by **Bill Habeck**, and is reproduced in its (almost) entirety...

"The wedding of Stephanie and Jim took place in Cambridge at the Royal Sonesta Hotel. I was a guest for the wedding, the reception, the rehearsal dinner the night before, the Charles River Cruise the night of the 30th, and a breakfast on the 31st. I have never heard of a wedding (Bill Gates' excepted) with as many events...

"The rehearsal dinner took place at the Harvard Club on Commonwealth Avenue in Boston. There were on the order of 100 guests, and the main event of the evening was an elaborate multimedia roast of the couple, with 98 percent of the heat focused on Jim—and deservedly so. Jim did get in a videotaped retaliatory strike aimed at his brothers Michael and Billy. Also at the dinner were **Hal Cohen** and his wife Julie "Spit" Temple Cohen, '90, Adam Bernard, '86, David Her-ring, '84, Jay Cohan, Ted Sylvan, '84, Cheryl Larivee-Elkins and many others...

"MIT Alumni in the wedding party included **Dan Kennedy** and **Lowell Kim**. There were about 300 guests at the (actual) wedding and reception. The band at the party was excellent and they let Jim play the drums for one or two songs near the end. There was a total of between 20 and 30 MIT alumni/ae at the wedding, based upon the MIT photo taken of us after the reception...

"The Charles River cruise and the post-wedding breakfast maintained the high standard of excellence set by the previous events. The high points for me were being the first one on the boat for the cruise (and grabbing a table strategically located between the two buffet tables), and being able to say the phrase 'There's Up-Chuck River University' when we passed Harvard.... All-in-all, it was a most enjoyable and memorable experience...."

Bill moves on to provide his own update: "I am still working for Hewlett-Packard in Cupertino, where for the past four years I have been writing diagnostics for PA-RISC computers (multi-user and workstations). These are used predominately by manufacturers to verify the quality of assembled parts. After living in Mountain View for six years, I decided to move closer to work. Taking advantage of the low interest rates, I bought a

two-bedroom condo in Santa Clara in April 1993. Over a year later, I am finally done furnishing the place, though it could use some more art and plants...." Bill concludes that he was looking forward to attending the World Cup Soccer quarterfinals hosted at Stanford in July.

Coincidentally, Class Treasurer **Jim Lin** dropped me a line this month. He writes that he (also) got married in May of 1993, to May Chiu. **Krishna Komanduri** was in the wedding party, and other attendees included **Dave Jesurum**, **Dave Maes**, **Stan Oda**, **Gina Chung**, '89, **Elizabeth Greyber**, '89, **Jay Cohan**, **Gene Cohen**, **Craig Dunbar**, SM '86, **Joan Fand**, '89, **Hiroki Morizono**, **Chris Young** and **Rod Moreno**. **Krishna** is finishing his internal medicine residency at UCLA and will be doing a fellowship in hematology/oncology at the University of California/San Francisco. Both **Stan** and **Dave** (Jesurum) are engaged and are now planning their respective weddings. **Jim** and **May** have both finished an internal medicine residency at Oregon Health Sciences University in Portland, and are now continuing their training at the University of Chicago. **Jim** in anesthesiology and **May** in nephrology.

Todd Abler updates us from Meridan, Miss., where he just finished up intermediate flight training in the T-2 Buckeye at the end of March. The finale of his training was carrier qualification, which was done on the USS *Eisenhower* off the coast of Key West, Fla. Before his advanced flight training in the A-4 Skyhawk, **Todd** spent six days sailing on a 30-foot boat from Pensacola to Cancun, Mexico. He also got to the first weekend of the New Orleans Jazz Fest, where he had a great time and saw performers such as **Jimmy Buffet**, **Boz Scaggs**, and **Buddy Guy**. **Todd** is hoping to finish up flight school by the end of this year.

Melissa (Krawiczki) Lewis has written in thanks to **Dave Carter**, who provided the Class of '87 e-mail address. **Melissa** married **Matt Lewis**, '86, in June of '88, and moved to Santa Fe, N.M., after spending a few weeks that summer working for MIT Professors **Heather Lechtman** and **Dorothy Hosler** in Ecuador. Since then, they have both worked for Los Alamos National Laboratory. For four years, **Melissa** worked in the foundry on near net shape castings, and now leads the mechanical test section. **Matt** has been doing "fun" modeling work in the Engineering Science and Application division; he concurrently finished an MS degree "with distinction" at the University of New Mexico, and has recently started a PhD program there. Most exciting is the birth of their twins, expected this past May! As far as contacts with classmates, **Melissa** and **Matt** recently had dinner with **Galen** ('85) and **LeNore Kerber** when they drove through Santa Fe over the holidays; they are now living in Colorado.

George Mitsuoka moved from Boston, where he was working at Starent Computer, to California in the summer of 1990. Until last March he was working for Apple Computer in the RISC hardware organization. He has since moved on to the 3DO Co., where he is involved in developing digital video technologies for consumer multi-media systems. He does some work at the Palo Alto public access television station, where he served on the board of directors, and also works as a regular crew-member for several cable TV shows. Over Christmas, **George** took a trip to

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Cozumel, Mexico, and was able to obtain his PADI scuba certification. This past April, **George** was in Boston to attend the retirement of longtime fencing coach **Eric Sollee**. Over 100 alumni/ae and guests were in attendance, including **Joe Levis**, '26, a silver medalist at the 1932 Olympic Games. **George** also takes time to pursue lots of outdoor activities, some in conjunction with other MIT Alumni/ae: R/C glider flying at the beach with **Russ Holtz**, '85, tennis and fencing with **Alice Chang**, '90 (until he set her up with one of his co-workers...), and target and trap shooting, as well as motorcycling, with **Mike Matter**, '84. **George** has also seen **Ann Zabudoff**, '86, a few times in Pasadena, and saw **Gerry Luppino**, PhD '89, in Hawaii. (Both **Ann** and **Gerry** were pictured in the January '94 *National Geographic* article on astronomy.) **George** plans to stay at 3DO for the next couple of years, and then hopes to go to graduate school. He would ultimately like to start a non-profit organization to create educational multi-media titles, and (near-term) would like to get his power flying license.

Tom Abell e-mailed to say that he has just graduated from the Leaders for Manufacturing Program, and is heading out for California to work for HP in Palo Alto. **Tom** mentioned that **Steve Geiger**, his freshman roommate at East Campus, is still working in Moscow (he has been in Russia for a number of years). . . . **Pete Scully** is still in Boston working for Lotus.

Michelle Kirshen and **Avrim Blum** sent a short note to announce the birth of their son, **Alexander Martin Blum**, born April 28, 1994. "A (slightly) biased opinion says he's soooooo cute. Everybody's doing fine... Sleep... what's that??"

Via the Alumni/ae Office, we received updates on a number of classmates. (Don't forget to fill out the *Technology Review*/Class Notes section when you send a donation to the Institute—these do eventually get to me!) **Rachel Graber Colton** is currently working for Bell South Telecommunications as a new services planner. She is the Georgia planner for the Advanced Intelligent Network, and is involved in the establishment of new area codes. **Rachel** completed an MBA at Georgia State University in June 1993, and is starting a master's degree program at the London School of Economics this fall in International Accounting and Finance.

Yael Zheng is finishing up her second year with Northern Telecom's Marketing Leadership Development Program, where she is a product manager in the PCS wireless product marketing group. She got married last November to **Wynn White**, who works as a financial analyst at Oracle. . . . **Maria Kozloski** is currently working for the World Bank, and, as a result, can recount some great stories about China. She will soon, though, be focusing on her real love, which is Eastern Europe and Russia. . . . **Constance Perrier** has recently joined the Real Estate Investment Banking Group at Lazard Freres and Company in New York City, where she works as an associate. . . . **Kevin Bartus** just finished up an MBA at Harvard Business School this past May. Last



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October, he married Molly Sheichet. After spending this summer in Providence, R.I. (where Molly works), Kevin is off to Toronto, where he will work for the Boston Consulting Group.

Finally, we end on a sad note. Classmate Robert S. McCartney passed away on March 22, 1994. Robert received an SB in management with us in 1987, and an SM in management from the Institute in 1990. He lived in Santa Barbara, Calif., and worked as an associate at Warren and Selbert, Inc. We extend our deepest condolences to his family.

Thanks for all of your contributions!—Jack Leifer, secretary, 16 Tavo Ln., New City, NY 10956, (914) 634-2007; e-mail: <leifer@ccwf.cc.utexas.edu> or <MIT1987@mitvma.mit.edu>

88

I love weddings and if it were not for a wedding this month's column would be extremely short. Please write and let us know where you are working, living, and how

much RAM your computer has. My SPARC 10 has 100MB.

Mike Garrison is working in noise engineering for Boeing's newest plane, the 737-700. Mike is enjoying life in Seattle and has been doing a lot of rock and mountain climbing. He recently completed a climbing class with the Washington Alpine Club and plans to reach the top of many peaks this summer. . . . Greg Bonafede was kind enough to send me reunion photos which I will save for our 10th reunion in the year in '98. Greg graduated with a master's degree in English and will now be teaching at the U.S. Air Force Academy in Colorado. Michael Keirnan is working for Sybase in Burlington, Mass.

On May 29th, Larry Candell married Amy Bertin, '87, at the Charles Hotel in Cambridge. It was a beautiful ceremony and a lively reception (the dance floor was packed). Larry works at Lincoln Laboratory and Amy is a Harvard graduate student studying economics. It was a real MIT wedding with 42 MIT alumni/ae present and 8 MIT couples! Alumni/ae included the bride's father, Mike Bertin, '63, the groom's sister, Emily Candell, '90, and the groom's cousins, Amy Roschelle, '93, Jeremy Roschelle, '85, and Rachel Obstler, '92.

Twelve other classmates (all Bakerites) attended the wedding. Adam Schwartz was an usher. Adam is pursuing a PhD at Berkeley and hopes to graduate soon. Gerald Cohen came with his wife, Elizabeth Brandwein. Gerald works at the Federal Reserve Bank of New York and they both enjoy New York City life. . . . Joycelyn (Valderrama) Koehler and Dave Koehler, '87, reside in Massachusetts. Joycelyn is a mechanical engineer at A.W. Chesterton and Dave is in his last year of residency at MGH in anesthesiology. . . . Geeta (Khare) Aggarwal and her husband, Achal Aggarwal, '87, are moving into their new house in Shrewsbury, Mass. Geeta works at Digital and Achal is finishing his residency in pediatrics and plans to begin working for a local HMO. . . . Steve Alberts and Cathy Comeau, '87, also live in Massachusetts. Steve is working at JYACC, a small software and consulting company. . . . Alan Sabarra lives in Miami and works for United Airlines as a market analyst. . . . Tom Stewart and his wife, Susan (Rowell),

'87, live in Belmont with their two young kittens. Tom works at Meditech and Susan works at HMM Associates—Earth Tech. . . . Alec Jessiman and his wife, Elaine, recently drove across country and eloped. Alec works at Reebok designing sports shoes and Elaine is a fifth-grade teacher. . . . Mark Light is engaged to Jill Gauding. (I had more info on this couple, but during the wedding festivities, I misplaced my notes and the dog ate my homework.) Mark, please write in with all the details. Also at the wedding was Kamala (Sundaram) Grasso and her husband, Paul.

Another large group of Bakerites attended the wedding, but this group graduated 25 years before our class. Martin ('63) and Andrea Schrage, Ira ('63) and Violette Blumenthal, Frank ('63) and Sue Model, Larry ('63) and Margie Krakauer, Peter ('63) and Carol (Gustafson), '65) Van Aken. This group enjoyed the wedding and were thankful that the bride's father told NONE of his favorite jokes. The class of '87 also had a large delegation, including Roger Applewhite, '87, David and Pam (McHatton) Graham, both '87, Adam Kane, '87, Elmer Lyons, '87, Ahmad Tabari, '87, Ken Vogel, '87, and Dan Cousins, '87. Representing the random years were Michael Yokell, '68, Michael Cafferty, '83, Donald Davidoff, '86, Rick Feinleib, '86, Andy Singer, '89 (my husband), and Todd Sinai, G.

Have a happy Halloween.—Cathy Singer, secretary, 131 Main St., Andover, MA, 01810; <singer@mit.edu>

89

There are over 60 people now on the Class of '89 e-mail list, so if you are interested in being on the list, please e-mail me at the address below.

Those on the list will be receiving this article about three months early.

Also, the Class of '89 World Wide Web site is up; it has pictures from the reunion, information about class offices and our class scholarship, a list of '89ers with web pages, and more. Any suggestions for additional information will be welcomed! The URL is: <<http://tns-www.lcs.mit.edu/mit89/>>.

Here is this month's list of people to please write in: Yon Chung, James Ferry, Karen Lewis, Stacey Rogers, and Dick Wheeler. What are y'all up to? If anyone knows about any of these people or anyone else, please write in!

Carissa Climaco was nice enough to sum up our class reunion events for us: After the Pops, a whole slew of classmates met up at the Cambridge Brewing Company. It was a great chance to meet up with folks and even to meet classmates we did not know before. Juli Lee (reunion chair) just finished up her first year at the Sloan School. Elliot Marx is living and working in Winchester, and he even has his own disc jockey business. Ron Koo came in from California where he is working for Maxim. Jen Sokolowski also was in the area from California where she is working on a physics PhD at Berkeley. Jackie Berger is working on a PhD in economics at Princeton.

At Technology Day, Ken Goodson was mentioned for distinguishing himself in the MIT music department with his choral talents. Ken is now touring Germany. At the Tech Day luncheon, our class goal of 50 percent partici-

pation since graduation and a class reunion gift of nearly \$20,000 was also announced, a portion of which was designated to continue growth of the Class of 1989 Scholarship fund, which provides financial aid to students who have shown a sustained commitment to public and community service.

Friday night we had a class party at Baker House with more than 70 people attending. **Eric Reifschneider** came in from Chicago where he is practicing law. **Jinnie Jung** was there with her husband, **Young Yoon**. Jinnie and Young live in Toronto, where they were married last October. Jinnie's bridesmaids included **Eun-Jung Park** and **Salma Saeed**, who were both at the reunion.

We had trouble getting the Baker House stereo, so **Elliot Marx** came to the rescue by bringing in his deejaying equipment. We dined on six-foot long submarine sandwiches and beer, reminisced over our *Freshman Picture Book* and *Techniques* from 1986 to 1989, broke open an "'89" pinata, and learned just what everyone has been doing over the last five years.

At the Alumni/ae Challenge Games, the Class of 1989 was competitive through the first half of the events, but did not fare as well in the end. Highlights included winning the distance portion of the paper airplane contest with **John Smullen's** creation, and correctly answering in the Alumni/ae Bowl that there are one female and three male bathrooms in the Infinite Corridor. In the future, we expect to do better in the "get as many people as possible in the rope that's tied off into a big circle" contest when classmates have more little children to put in the circle. **Tim Collins** and his wife, **Jennifer**, who had plans to attend the reunion, instead became the proud parents of a baby boy named **Benjamin Taylor Collins**. Tim's father, **Joe Collins, HM**, brought by a picture and helped cheer us on by squeezing into the rope circle with us.

Later that night, we had a sumptuous Chinese banquet at nearby Royal East. The multi-course meal was served to some 50 classmates in attendance, including **Angelina So**, who is working for Synopsys in the San Francisco area. **Mike Parker** works from his RV while roaming the country. **Dave (Duis) Story** and his wife, **Christy**, came in from Sunnyvale, Calif. **Lisa Robinson** is living in Portland, Maine. Afterwards, many of us went dancing at Zanzibar where we ran into a bunch of folks who were not registered to go to any other reunion events, and even some people from the Alumni/ae Association.

Even after the big dinner and late night of dancing, many people came to the Sunday morning brunch at Capucino's, where we selected the class officers for the next five years.

Our new Class Officers are: president, **Carissa Climaco**; vice-president, **Dave (Duis) Story**; secretary, **Henry Houh**; treasurer, **David Goldstone**; class agent, **Christine LeViness**; members-at-large: **Hugo Ayala**, **Laura Brauer**, **Elliot Marx**, **Mike Parker**, **Lisa Robinson**, **Angelina So**, **Cindy Wang**; ambassador, **T.K. Wong**, who came all the way from Singapore for the reunion.

Kenney Ng and **Carissa** got engaged while on vacation in Australia in April. **Cindy Wang**, **Vivian Liu**, Vivian's roommate, **Terry Tang (UMich '89)**, and **Alex Caro, '90**, threw a surprise engagement barbecue on the Sunday

evening of reunion weekend. Classmates in attendance included **Suephy Chen** (who is finishing up a year of internship at Beth Israel in Boston before heading off for a dermatology residency at Emory in Atlanta), **James Yao** (who was in town from Beijing), **Ron Koo**, **Derek Chiou**, **Eric Chang** (who is working at Lincoln Labs), **Henry Houh**, who provided a guitar, and **T.K. Wong**, who provided voice as the evening's entertainment.

Carissa, who is a housing policy analyst with the Housing, Income Security, and Employment Research Area at Abt Associates, ran into **Amy (Austria) Karagozian**, who started The Winnbrook Co. in Belmont, specializing in original baby accessory designs. **Bhavya Lal** also works at Abt doing science policy research. **Carissa** will be going back to MIT in the fall for an MCP (master's in city planning) degree.

Angeli Salgado Maney and **Bill Maney**, who both attended the reunion, are settling into their new house in Redwood City, Calif., which they bought in March. **Angeli** recently started her own business, providing accounting and pension services to sole proprietors and corporations. "It's exciting and risky," **Angeli** writes. "But at least I get to work at home for the most part. I also get to take my vacations whenever I want. What a concept." . . . **Karen Yu** is working on a PhD in psychology (visual perception) at Vanderbilt. **Karen** is in the process of running her dissertation experiments, and was hoping to be done by the end of the summer.

Eric Lund is pursuing a PhD in physics at Dartmouth College. **Eric's** field is space plasma physics, measuring high-frequency electric fields in the aurora borealis. "The instrument flies aboard sounding rockets, which are launched from near Fairbanks, Alaska. I have had two launches. One had a spectacular 'first-stage motor anomaly' (i.e., it blew up); the second launch was successful." **Eric** continues that he "saw two other New House alumni/ae on campus last weekend: **Cynara Wu** has gone back to MIT for a PhD in EECS and is now a floor tutor at Baker House, while **Chris Moore, '90**, is working toward a PhD in physics at MIT. He is a floor tutor at Next House." . . . On June 5 (exactly five years from graduation), **Jenifer Tidwell, '91**, and **Richard Carreiro** got married in Portsmouth, R.I. **Jenifer** and **Rich** are now living in the south-of-Boston suburbs.

Christy Alvord will be working in Warsaw, Poland, until September '95 through the MBA Enterprise Corps. "They are a non-profit that matches recent MBA graduates with private companies in countries that are moving from socialist to free market economies," **Christy** writes. **Christy** will be at Poland's High Tech Lab.

On June 9th, **Chris Carone** graduated from Harvard University with a PhD in high energy physics. Now he is a postdoctoral fellow with the particle theory group at Lawrence Berkeley Laboratory, in Berkeley, Calif.

While our fellow classmates are graduating with doctorates, I'm still jumping through hoops here at MIT. I managed to pass my area exam in May, and the following day went off to Paris and Geneva. I was organizing a workshop at the First World Wide Web Conference, and managed to do some sightseeing as well as getting together with **Alice Biber** and **Charlotte Biber**, who are both working on

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PhDs at ETH, the Swiss Federal Institute of Technology, in Zurich.

Mark Moss is still in the Army Signal Corps. **Mark** is currently stationed in Okinawa as a detachment commander with Army Space Command. "Hopefully, I'll get to pin on my 'railroad tracks' (captain's bars) any day now." **Mark** returns to the States in January '95, and would like to enter graduate school for a PhD in the fall of '95 for computer systems engineering.

Laura Carter is a PhD candidate at UC/San Diego School of Medicine. "I love living in Southern California," **Laura** writes, "and spend my 'spare time' at the beach running or rollerblading."

Thao Nguyen was awarded an MD degree from Baylor College of Medicine in Houston on June 6th. **Thao** has been accepted into a preliminary medicine internship at the University of Illinois at Urbana-Champaign to be followed by an ophthalmology residency at the University of Illinois at Chicago. . . . **Jason Nieh** is at Stanford, and has "probably got another year. Research has been busy, along with helping out with the youth group in my church and doing some music stuff."

Jim Reich wrote to be added to the e-mail list, and also forwarded along some news (hint, hint). "I've been at Orbital Sciences in Chandler, Ariz., for the past two-and-a-half years, cobbling together rockets from surplus missile components that are consistently older than me. Prior to that, I had been at General Dynamics Space Systems in San Diego, working on the Atlas Centaur. Now I'm preparing to head for grad school at either University of Michigan or Carnegie Mellon. I'm not looking forward to the weather after being spoiled out here, but it'll be good to return to the East."

Jim passed along news about other '89ers: **Cheryl Blake** got married to **Mike Pope**, an Aussie, and moved Down Under. **Cheryl** is working on a PhD in computer science at the University of Adelaide. "As far as I know, she hasn't taken up surfing yet," **Jim** writes. **Kia Freeman** is still at General Dynamics in San Diego, but probably not for long due to the buyout. **Karen Koyama** is living in L.A., working at TRW. **Karen** recently got engaged, and is planning to move up to the Bay area. **Nat Seymour** left Orbital Sciences, and is currently a graduate student at the University of Arizona. "Nat must have decided that there weren't enough people shooting at him, so he joined the Army Reserve, and will be in Basic this summer."

Dave Fleming, who also signed up for the e-mail list, forwarded some news along (hint, hint again).... "I feel like as long as I'm sending you e-mail that I ought to give you some news for the Class Notes. However, I don't have any news of myself—I'm just hanging around the University of Maryland still trying to get a dissertation together—nor have I run across any other class of '89 people lately. **Joe Orso's** truck was stolen again. Does that count?"

Well, that's it for this month; thanks to everyone who contributed e-mail. There are still some calendars left for those of you who



Nuptial celebrants (from left): Aaron Sodickson, '91, Hoon Ko, '90, Raul Acevedo, '92, Jay Damask, '90, Julia Kent, Karlin (Anderson) McIntyre, Sean McIntyre, '89, Heidi Miracle McMahonill, '91 (the bride), John Travis, '90, Dan McMahonill, '91 (the groom), Dean Miller, '91, Lisa Beausoleil, Sean Beausoleil, '88, Songmin Kim, '86, Jordan Jarvis (the baby—'09?), Bob Jarvis, '89, Bennett Brown, '91, and Gina (Thompson) Jarvis.

would like to contribute voluntary class dues! Thanks, and please send photos for next year's calendar (we'll even accept GIF or any electronic file format for photos)!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142, phone: (617) 225-6680, fax: (617) 253-2673; e-mail: <hhh@mit.edu> or <henry_houh@mit.edu>; World Wide Web URL: <http://tns-www.lcs.mit.edu/mit89/>

90 5th Reunion

Eloisa Tejero recently transferred from New York to London to become

manager/director of the European Operations of Myers-Holum, a consulting company. She's traveling throughout Europe and having a wonderful time! Eloisa hopes to return to New York in another year and a half. . . . In the United States, managing the East Coast Operations of Myers-Holum, is **Jessie Wong**, and consulting in the Los Angeles office of Myers-Holum is **Rock Fu**.

In graduate schools we find that **Jamie Wong** has just completed a three-week rotation for medical school at Oxford and will be interning in San Francisco. . . . **Melissa Ko** just graduated from Wharton and will be working for Citibank in New York City. This past spring, Melissa Ko and Alex Mayes, '91, dropped by to visit Eloisa Tejero in London as well as making a stop in Amsterdam. . . . **Teresa Lyons** is still in the Boston area, working on a PhD in biology at Brandeis University. Teresa anticipates finishing her work in one more year. . . . **Supreo Ghosh** received a master's degree this June from MIT's Sloan School of Management. . . . **Joe Kowalski** and **Mark Strong** will both be starting the Leaders for Manufacturing Program at MIT's Sloan School of Management. The LFM Program is a joint program between the Sloan School and MIT. Students earn a master's degree in engineering and either an MBA or a master's in

management from the Sloan School, which, by the way, was ranked as the Number 2 business school in the nation by *U.S. News & World Report* ahead of neighboring Harvard Business School.

Margaret Coughlan graduated from New York University Medical School this May, only one week before her marriage to Dave Walker, '91. Margaret began her residency in June at Brown University. . . . **Stefan Treatman** took his candidacy exam in mathematics at the University of Michigan, and in his spare time manages two softball teams and a baseball team. Additionally, after three years as the unheralded sixth man in the Michigan Wolverine's "Fab Six," Stefan has declared himself eligible for this June's NBA draft (will Stefan be the first Class of 1990 graduate to play in the NBA?) . . . **Heidi Burgiel** is also in graduate school. She hopes to receive a PhD by June 1996. . . . **James Dailey** is a graduate student at Penn State. He'll be getting a master's degree in August and then will stay to work on a PhD in aerospace engineering.

In the working world, we find that **Jennifer Wright** will be leaving Hughes Aircraft in California to work for Adroit Systems in Alexandria, Va. . . . **Scott Hochgesang** recently accepted a position with Times Mirror Cable Television, after working for three years as a management consultant at LEK/Alcar in Los Angeles. At Times Mirror, Scott is the manager of interactive service. He looks for investment opportunities in the interactive television market, as well as planning the corporate strategy for launching new interactive services in cable systems. Times Mirror has the seventh-largest broadband network in the country. Scott is also enjoying beach life at his home in Laguna Beach, Calif. He notes that moving to Laguna Beach has been a pleasant change from the crazy environment he left in Los Angeles.

In May 1993, **Todd Bryan** received a master's degree in structural engineering from the University of California/Berkeley. Now Todd works as a management consultant for the

Boston Consulting Group in San Francisco. He spends weekends mountain biking and forgetting those awful Boston winters! . . . **Fran Smith** is working in manufacturing at the Ford Motor Co. while working toward an MBA at night from the University of Michigan. In February, Fran spent a week in Cozumel, Mexico, scuba diving. She had a fabulous time and reports that the water is clear down there and the coral is beautiful! . . . Congratulations to **Renee Picard Parry** and her husband, Don Parry. They are the proud parents of a baby girl, Amanda Renee.

How was everyone's vacation? Any suggestions for our first class reunion next June? I've just moved from Boston to take a consulting position at American Management Systems in Redwood City, Calif., so please write to me at my new address.—**Ning Peng**, secretary, 2157 El Capitan Ave., Santa Clara, CA 95050

91

The 1991 Class Notes have entered the computer age. For several months now, **Renee (Mong) Miller** has been editing e-mail news to and from classmates on the Internet. E-mail is

now forwarded for inclusion in *Technology Review*. Renee is a lieutenant with the Air Force in Los Angeles, where she lives with her husband. She reports that she ran in the March Los Angeles Marathon, and travels for her job about every other week. Her cyberspace news report includes news about several classmates: **Paul Deitel** is a co-author of the book, *C How to Program*, published in January and used at colleges across the country—but not MIT, yet. **Yves Dehnell** studies biochemistry at Brandeis and is still producing his *French Kisses* radio program on WMBR. Yves visited with **Reba Sundharadas** during a trip to France, where Reba is writing software for CGI, a French company owned by IBM. **Joe Wang** is working on an astrophysics PhD at the University of Texas at Austin. His study focuses on numerical solutions of type II supernovae. Joe is also involved in the Globe-wide Network Academy project, which is an effort to organize an on-line university on the internet. **Monica (McConnel) Niles** works in MIT's admissions office. **Lynore Abbot** is enjoying her work for Polaroid in Cambridge.

Juan Alonso is working on a PhD at Princeton and enjoys the comparative quiet of Princeton's pastoral setting. **Brian Katz** and **Sue Pauwels**, '92, were married in 1992 and now live in New Jersey. Sue performs microbiology research for Hoffman-LaRoche, and Brian teaches physics. Brian helped to design a new physics room filled with the latest equipment which New Jersey's governor visited last spring. **Andrew Alleman** graduated with a master's in electrical engineering from the University of Washington. **Michael Leary** is pursuing a PhD in electrical engineering at Cornell. **Amita Gupta** is at Harvard Medical School, after travelling to India, Eastern Europe, and the American Southwest. **Neil**

Okamoto develops computer animation and image processing tools, including CAPS (computer animation production system), for Walt Disney. Dave Toback married Meg Lobitz (Univ. of Chicago '93) in January. Attendees included Marianne and Robert Fleischman and Donna Khodarahmi, Roberto Estrada, '92, John Ragland, '92, Mark Smith, '92, Chris Wren, '92, Doug Walker, '94, Chris Stroup, '94, and Greg Powell, '94.

Heidi Miracle and Dan McMahon were married during the summer of 1993, with several MIT alums in attendance. Members of the class of 1991 included Aaron Sodickson, who is in the MIT/Harvard MD/PhD program studying medicine and physics; Karlin (Anderson) McIntyre, who works for the Navy as a civil engineer; Raoul Acevedo, who works for GCC Technologies outside of Boston; Gina (Thompson) Jarvis, who recently gave birth to a second daughter; Dean Miller, who is an editor for computer books in Indianapolis; and Bennett Brown, who is teaching in Chicago. Others at the wedding included Helen Ko, '89; Jay Damask, '90, who is doing graduate studies at MIT; Julia Kent, '92; Sean McIntyre, '89, who is working in computers outside Washington, D.C.; John Travis, '90, who is a writer for *Science* magazine's Boston division; Song Min Kim, '85; Bob Jarvis, '89; and Lisa and Sean Beausoleil, '88. Dan also sends news that Jenny Lemberg is studying at Columbia Law School, and that her husband, Bill Greenberg, '89, is doing post-doctorate work in Philadelphia. Heidi is still working full time for the American Cancer Society and plans to finish her thesis at Emory soon. Dan recently completed his satellite modulator project at work. Dan says that a satellite modulator is the device that sends signals from earth to the satellite, so I imagine his work is a very important project for those of us who live in cities without underground cables to bring us television signals. When Dan spoke with me in May, he said he was trying to get all his running in before it got too hot in Atlanta, where Heidi and Dan live. Dan and Heidi visited Disneyworld for the first time during their honeymoon, where Dan says his favorite ride was Space Mountain.

Chantal Moore and Mark Naugle became engaged in February. Both work in London—Chantal works for Gemini Consulting and Mark works for the Wilkerson Group in health care consulting. . . . Lieutenant j.g. Bill Moliski might be spending some time near London, sort of, since his submarine, the USS *San Juan*, spent the summer underneath the North Atlantic ocean. The Navy reports that Bill is one of 130 crewmembers on the 360-foot nuclear sub. . . . Brian Quinn also plans to spend some time surrounded by a cold, frothy liquid—he is “looking forward to brewing my own beer and drinking it.” Brian graduated with a master's in aeronautics and astronautics from Purdue in December 1993, and now lives in Baltimore.

The *Buffalo News* reports that Joseph Sorci married Stacy Ann Slagor in April and that they now live in Boston. . . . Tim Hazen is working towards a PhD in electrical engineering at MIT. With the new school year, Tim is a graduate resident tutor living in East Campus 2W. . . . John Chen is also at MIT, studying for a PhD in materials science and engineering. In March, John went to Pittsburgh for the 1994 APS meeting. “To my great sur-

prise,” says John, “I also met Mark Wisnudel, Susanne Perutz, Trisha Wilson, '90, Ellen O'Connell, '89, and Leo Balentz, '89, who were attending the meeting. We had a great time eating dinner at Houlihans.”

The legal world can look forward to welcoming a new crop of MIT alums to its midst. Arlene Yang graduated from New York University Law this spring and is clerking for a judge in federal district court in the fall in Reading, Pa. She says, “I am looking forward to finding out what lawyers really do.” Pete Stewart, Jane Williamson, and I all graduated from Boston University Law, after listening to Ross Perot's commencement speech, in which he made no less than half a dozen references to MIT (favorable ones, too!). Pete will associate in New York with the law firm of Skadden, Arps, Slate, Meagher and Flom, and I will associate in Boston with the law firm of Brown, Rudnick, Freed, and Gesmer.

Please send all your favorite news to Andrew Strehle, secretary, 59 Commonwealth Ave., Apt. 4R, Boston, MA 02215, (617) 262-3495. Send e-mail to Renee Mong: <miller-rl@post7.laafb.af.mil>.

92

Just missed this in the last column. Albert Cheng received an Outstanding Alumni Award from A Presidential Classroom for Young Americans, Inc. It's an organization

that offers programs which help prepare outstanding high school juniors and seniors for future roles as civic leaders by providing first hand exposure to government in action. Albert attended their Presidential Classroom program in the summer of 1987. Albert is currently working for the Boston Consulting Group and will be attending Harvard Business School in the fall of '95.

Sean Dougherty finished a master's degree in International Relations at Rice University in August. He and his wife, Yan Sima, hope to work in the far East for a few years before returning to the states for more grad school. Sean spent six months studying in Beijing, China, after graduation where he studied Chinese and courted Yan whom he met four years earlier in a summer program. Sean and Yan were married last summer in a Chinese garden in Houston; their reception was held in a log cabin to give it a distinctive “Texas” feel. They spent their honeymoon in the mountains of Yunnan in southern China near Vietnam. Yan, an aspiring writer, currently teaches and translates in Houston. My direct and sincere apologies to Sean who called me last year with all of his news. I could have sworn I reported it already. Please forgive the oversight.

Pete Wainman got in touch with me a few times to see if I could help him with some addresses or phone numbers of other alums that he could speak with about his potential job choices. Anyway, after all of his research, interviewing, and deliberation, Pete accept-

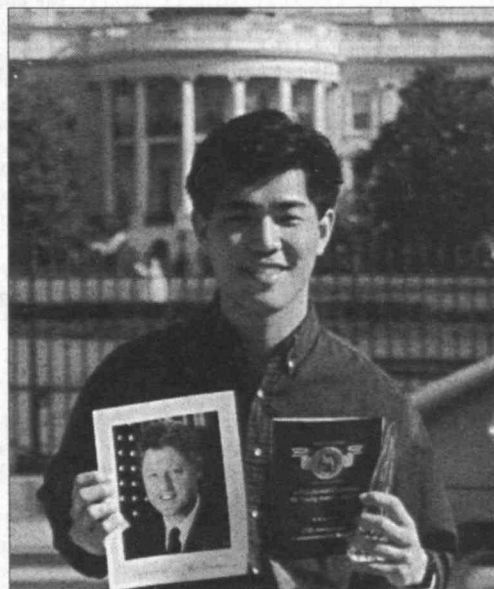
ClassNotes

ed an offer in L.A. with Donaldson, Lutkin, and Jenrette. He will be working mostly with former Drexel people.

Valarie Thomas received a master's in chemical engineering from Univ. of Michigan in December '93 and she is now pursuing a doctoral degree in chemical engineering. Valarie is a secretary as well—like me. She is corresponding secretary for the executive board of BAMIT. . . . Elizabeth Booth was married on August 6 to Stewart Taub, BS chemical engineering from Cornell '92. . . . Brad Layton is still training in northern Virginia for the U.S. sculling team. Go Brad! . . . Rahul Shah is still at Monitor Co. in Cambridge. Rahul says that Riz Virk and Mitch Liu have started a company called Brainstorm Technologies, which develops applications for the groupware market.

Jennifer Hill West writes that she was in Boston in April and saw Theresa Derderian who is now working in Bethlehem, Pa. Jennifer received a master's in biomedical engineering on May 21 from UTexas at Austin. She is continuing on for a PhD, probably at CalTech. Jennifer recently filed a patent on local delivery of fibrinolytic agents for the prevention of postoperative adhesions, and she had a paper published in the June issue of *Proceedings of the National Academy of Sciences*.

To get news to me, write to me in New York. I'll be moving back there some time this month. Thanks. Way more news to come in November, couldn't get everyone in this time.—Leslie Barnett, secretary, 56 Brown St., Mineola, NY 11501, (303) 925-1961



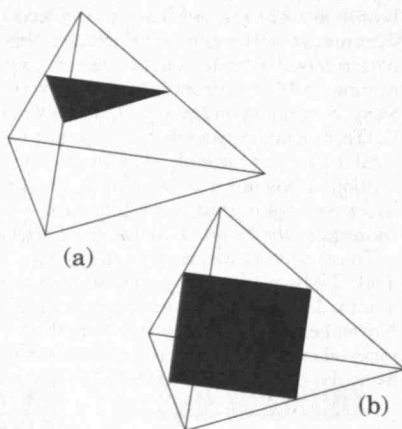
“Here I am in front of the White House with the Outstanding Alumni Award from the Presidential Classroom program and a corny signed picture of the Prez.”

—Albert Cheng, '92

Puzzle

Continued from Page MIT 71

Since all four vertices cannot lie on the same side of the plane, the plane must either pass between a vertex and the opposing face or between two opposing edges. For each of the four vertices, the plane passing through the midpoints of the three adjacent edges is equidistant from all vertices (a). For each of the three pairs of opposing edges, the plane passing through the midpoints of the four edges joining them is equidistant (b). Hence the total number of equidistant planes is seven.



M/J 3. The late Bob High was "behind the eight ball": A billiard ball with a small black dot on the exact top is rolled around a circle of radius equal that of the ball. Assume no slippage or twisting. Where is the black dot when the ball returns to its original position?

I will admit to some trepidation on this one. It is a problem from Bob High so an easy solution is not expected. Moreover, some of our regular contributors submitted moderately difficult solutions, but it seems

to me that the following simple solution from Eugene Sard is correct.

The intuitive answer is that the black dot is back on the top of the billiard ball when the ball returns to its original position. Surprisingly, however, the ball makes two complete revolutions in achieving this result. This can be seen by comparing the described situation with the cycloid generated by the black dot, if the ball were rolling on a flat surface. When the ball is halfway through its travels, the dot touches the fixed surface, which is at the top of the ball for the actual circular surface. Hence, one complete revolution has occurred when the bottom of the circle is reached, and the second revolution occurs in the remaining travel back to the top of the circle.

Kasner and Newman in *Mathematics and the Imagination* (chapter on paradoxes) describe a similar situation with one coin rolling halfway around a second identical coin.

I discussed this problem with my assistant, Maria Katsouras, and we agree that the "arc of contact" traversed on the ball must at all times be of the same length as the "arc of contact" traversed on the circle. Thus when the ball comes back on top of the circle, the ball's "arc of contact" is a complete (great) circle.

Other Responders

Responses have also been received from M. Fountain, D. Garcia, T. Godfrey, T. Harri- man, W. Hartford, R. Hess, M. Lindenberg, N. Markovitz, A. Ornstein, G. Perry, K. Rosato, L. Steffens, and N. Wickstrand.

Proposer's Solution to Speed Problem

Raccoonnookkeeper.

93

I hope I haven't shocked anyone by having two entries in a row. For starters, I'd like to thank all the people who contacted me. Also, I'd like to try something new. Each issue I

will ask several people from our class to write and tell me what they and their friends have been doing lately. The first lucky few are Natalya Eliashberg, John Gonzales, Karl Yen, Julia Stowell, Rebecca Witry, and Parag Shah. So, here's your excuse to call these people and make sure they have a lot to tell everyone. Now, on to the news!

Reshma Patel is in New York living with Mia Sakata. Mia is working at JP Morgan in

Mergers and Acquisitions. Karen Kaplan was living with them while studying journalism at Columbia. She spent the summer working for the *LA Times* in the business section and should be working for the *Miami Herald* when this comes out. . . . Helen Chang is in Phoenix, working as a process engineer. She just got two puppies—Biscuit and Muffin. . . . Sophia Yen and Steve Ko are in San Francisco. Sophia is at University of California San Francisco medical school. Steve is working at Apple Computers on systems software for the power PC chip. They were married June 8. In the wedding party were Mia Sakata, Mark Lee, Helen Chang, Mike Yu, Lisa Chow, and Liz Leung. Pictures have been promised.

Tim Wilson and Julie Lyren were also married recently, in Acron, Ohio. I should be getting some pictures from Scott Shiamberg, who is getting a graduate degree in architecture. In the past few months, he has traveled to Florida, Bangkok, Thailand, and Taiwan for his job. . . . Mark Lee was working at Intel in Phoenix, then returned to MIT to finish an SB degree. In his spare time he managed to enter the 10K competition with some other MITers to produce a diet/nutrition/exercise program. . . . Shen-yi Sieh is working for Procter and Gamble in Japan and spends half of her time flying around Asia helping out the local P&G with its products.

In other news, Pascal R. Lewis is pursuing a master's in manufacturing systems at Georgia Tech. . . . Hooman Davoudiasl is starting his second year as a grad student in physics at Caltech. . . . Diane Hern is at the University of Texas at Austin, working on a graduate degree in biochemical engineering. . . . Kristine W. Ma is attending the University of California at Berkeley graduate school. . . . Greg Best is in San Francisco working for Trimble. . . . And Chay Kuo got into the MD/PhD program at the University of Chicago. . . . Krista Holland writes, "I'm moving again!" The Department of Energy transferred her to the Rocky Flats in Colo., for the summer; now she's in Las Vegas working at Yucca Mountain, and in December she'll be off to study geotechnical engineering at the University of Minnesota.

Jeremy Yung just finished his first year in grad school at MIT. He hopes to finish a master's degree in aero/astro in about a year. After that, he'll probably stay on for another degree. . . . Masahiro Arakawa is currently a graduate student at the University of Southern California. He's busy working on a master's in computer engineering and his jump-serve on the volleyball court. Earlier in the year, he ran into Dan Kim taking a break from medical school to play volleyball on the beach.

Ken Ricci is finishing his first year in the physics PhD program at Stanford University. He is supported by an Office of Naval Research Fellowship and was doing research with Stanford's Free Electron Laser facility this summer. . . . Stacy Reeves is working for Intel in Portland, Oreg. This spring she was in Boston visiting Carrie Allen, who is going to Oxford grad school, and Marlo Torres, who is working for 3M in North Dakota. In July she'll be going to Israel on business and is hoping to stop in Oxford to see Carrie.

Terry Tsai is now working at Sapient, a small consulting firm in Cambridge. . . . Jim Hansen is still working at the Microsoft Graphics Product Unit testing Power Point, while his wife, Cathy Lachapelle, '92, is attending grad school at Stanford. Their son, Colin, is now 4 and "getting more clever every month." A second child was born around July 11. After Jim's loans are paid off, he plans to return to school for a PhD so he can do work in his real field of interest, water resources.

That's all for now. Make sure to get in touch with the people named at the start of the letter. If you want to get on the MIT Class of 1993 mailing list, you can subscribe by sending mail to <listserv@mitvma.mit.edu>. In the e-mail write: SUBSCRIBE MIT1993. Make sure there is a space between "subscribe" and "MIT1993." Of course I can always be reached by writing Mari Madsen, secretary, 12-16 Ellery St. #405, Cambridge, MA 02138

CourseNews

CIVIL AND ENVIRONMENTAL ENGINEERING



Thomas Maddock

Thomas S. Maddock, SM '51, has been appointed to the Western States Water Council by California Governor Pete Wilson. Maddock, CEO of Boyle Engineering Corp., is one of 51 members of this council. The council advises the Western Governors Association on water policy, particularly regarding federal leg-

islation. Maddock also serves as a member of the California Chamber of Commerce, where he is chair of the Water Resources Committee. He is also a member of the National Society of Professional Engineers, the Institute for the Advancement of Engineering, and the American Water Resources Association. . . . Charis Gantes, SM '88, PhD '91, sends word from Athens, Greece: "During a recent trip to Munich, Germany, I met two friends from my MIT days and we spent a few enjoyable days of skiing in nearby Austria. This meeting and all the memories it evoked gave me incentive to send in news. I met Kai Haase, SM '91, and Nikola Deskovic, SM '91, PhD '93. Kai is now pursuing a PhD at the Technical University of Berlin. His work involves developing design guidelines for shallow, triangular, large-span, glulam arches that often fail due to stress concentrations at the tip. Nikola is working for the consulting company McKinsey in their Munich office. One of the clients he is consulting for is Hochtief, one of Germany's leading construction companies. As for me, I was recently elected to an assistant professor position at the National Technical University of Athens. At the same time I am involved with some very interesting consulting projects, among them the designs of the new Athens subway system, of an electric power plant on the Aegean Island of Kos, and of Greece's largest dairy-product factory near Athens. I hope that the next time you

hear some news from me it will be in person, perhaps during the next ASCE Structures Congress that takes place in Boston next April. I am trying to convince friends and colleagues to combine this conference with a reunion."

Steven Harrod, SM '93, sends e-mail: "Since graduating from the Center for Transportation Studies in February of 1993, I have had a very turbulent career. Jobs were scarce in my original field of study (ocean freight management), so I took a job as an analyst at a small, remote, long-haul trucking company. This was a 'growth' opportunity at a company that was 'turning around,' but the company soon did just the opposite. Luckily, I made a quick job change and moved to Needham, Mass., where I now live. I am a logistics analyst at Lily Transportation Corp. in Needham. Lily is a road transportation firm specializing in truck leasing, turn key truck systems, subcontract transportation management, and, more recently, a specialized carrier of furniture. Last year I had two jobs in two states, moved twice, and had to file three separate state income tax returns! I have learned a great deal at Lily. Just recently I completed requirements for and received 'Certification in Transportation and Logistics' from the American Society for Transportation and Logistics. I am happy to say that my MIT education prepared me well for this challenge. Classmates can reach me at (617) 449-8686 and <cakeater@aol.com>."



Francisco Silva

Francisco Silva, SM '75, ScD '77, has been appointed manager of the new Geotechnical and Geoenvironmental Engineering program and a director in the Earth Sciences and Engineering practice at Arthur D. Little, Inc., in Cambridge. Silva spent 18 years as a consulting engineer with the T. William Lambe

group. Projects he has worked on include environmental problems and facilities, earth dams, embankments, excavations, oil storage reservoirs, landslides, foundations, pipelines, ports, and harbors. The new practice provides engi-

neering expertise for the solution of environmental and geotechnical problems in constructed facilities. . . . Mike Goldstein, SM '92, writes: "I am embarking on a four-month rotational assignment in the EPA Region 1 office in Boston to work in the Superfund program. Then it's back to D.C. to interpret a new law after reauthorization." . . . Glen Weisbrod, SM '78 (I, XI), has left Cambridge Systematics after 15 years, to head the Boston office of HBRIS, Inc. In his new position, he is focusing on economic impact analysis and energy planning.

Aaron Finerman, SM '51, ScD '57, of Ann Arbor, Mich., died on April 6, 1994. He was a visiting professor of computer science and engineering at Florida Atlantic University at the time of his death. A part-time resident of Boca Raton, Fla., Finerman spent part of the year in Ann Arbor as a professor emeritus of electrical engineering and computer science at the University of Michigan. He also served as a distinguished visiting scientist at the California Institute of Technology's Jet Propulsion Laboratory in Pasadena. Finerman was founding chair of the Department of Computer Science at the State University of New York at Stony Brook in 1970. He sat on many advisory panels, was appointed to numerous positions in national and international professional societies, and served as editor-in-chief on the journal *Computing Reviews* until he died. . . . The Association of Alumni and Alumnae has been notified that Henry Fisher, SM '32, of Berkhamsted, Herts, England, died on May 21, 1994. There was no further information provided.

MECHANICAL ENGINEERING

Rolf Dietrich, SM '79 (II, XIII), sends word from Canfield, Ohio: "I am commanding officer of the nuclear-powered submarine, USS *Sturgeon*, defueling in Puget Sound Naval Shipyard. I'm completing service with the Navy on September 1, 1994, and will be making the transition to an as yet undecided civilian career in engineering management." . . . From Bozeman, Mont., Sidney A. Whitt, SM '37, reports: "I can't help wondering how many of my classmates from the 24-member 1934 SM program are alive. I've had a very

DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering

ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering

MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science

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interesting career and life since that busy year at MIT as a Tau Beta Pi Fellow. For some years I've been retired as professor emeritus of S.U.N.Y. College of Environmental Science and Forestry. I live 90 miles north of Yellowstone Park, still hunt every year, and would welcome any of my classmates to a venison lunch or dinner if they venture this way." . . . Major Michael R. Helmick, SM '88 (II, XXII), writes from Harker Heights, Tex.: "I moved from executive officer to the III Corps Operations Officer to operations officer for 91st Engineer Battalion, 1st Cavalry Division in Fort Hood, Tex. My wife, Gina, and I now have two children, Stephanie, 4, and Katherine, 1. In my current position, I am responsible for operations, plans, and training for the combat engineer battalion supporting the Cavalry Division Ready Brigade. The Ready Brigade is prepared to deploy to contingency theaters within 24-48 hours of notification."

Stephen D. Mark, SM '93, is working in Newport News, Va., at the Transportation Engineering Agency. . . . George L. Niemeyer, SM '62, has been appointed to the newly created post of VP for Facilities Management at Lewis University in Romeoville, Ill. In this post, Niemeyer will have executive responsibility for planning, programming, design, construction, operations, and maintenance of the university facilities, including the management and performance of the Physical Plant Division. Formerly, he was regional director of properties at Trans World Airlines, Inc. (TWA). Niemeyer served for seven years as staff mechanical engineer at Argonne National Lab; two years as principal engineer at Borg Warner Corp.; eleven years at United Airlines, Inc., holding several management positions in facility and real property management; nine years as director of properties and facilities at Midway Airlines, Inc.; and two years at TWA. . . . Mauricio Casanova Bazán, '50 (IX), SM '69, has been elected a Fellow of ASME. He was cofounder of the first mechanical engineering school of Venezuela (Central University, UCV) in 1955. He was founder and head of the Power Generation Department, designer of its Thermal Machines Laboratory, and developer of its undergraduate and graduate curricula. For his many contributions, Casanova Bazán was decorated with the highest UCV Order in 1976. As a project and consulting engineer he introduced new approaches for power generation and water hammer problems, meriting the Venezuelan Association of Electrical and Mechanical Engineering Prize in 1976. He is the author of 42 technical publications.



MATERIALS SCIENCE AND ENGINEERING

Bruce W. Wessels, PhD '73, writes: "I have been elected to the board of directors of TMS and serve as chair of the Electronic, Magnetic, and Photonic Materials Division. I am currently a professor of materials science and engineering, and electrical engineering and computer science at Northwestern University." . . . James Scutti, '80, SM '82, has joined Massachusetts Materials Research, Inc. (MMR), as technical director. Scutti will be in charge of all professional engineering at the firm. He joined MMR from the G.E. Aircraft Engine Division in Lynn, Mass., where he was a



James Scutti

University in Bethlehem, Pa., has been named a cowinner of the R.R. and E.C. Hillman Award for "having done the most toward advancing the interests of the University." Hertzberg has conducted extensive research on the fatigue and fracture response of metals, plastics, and their composites. A member of the faculty since 1964, he was named to his endowed chair in 1978. He received Lehigh's Libsch Award for outstanding research in 1983, and the teaching excellence award from the College of Engineering and Applied Science in 1991. He is currently preparing the fourth edition of his widely used textbook on deformation and fracture mechanics, published by John Wiley and Sons. He is a Fellow of ASM International.

The Association of Alumni and Alumnae has been notified that James P. Robinson, '43, of Lowell, Mass., died on March 21, 1994. There was no further information provided.



ARCHITECTURE

A memorial service for MIT Professor of Visual Studies Muriel Cooper, who died suddenly on May 26, will be held at 11:30 am September 9 in the Cube, in the Wiesner Building. An exhibit of her work as a designer will hang in the Cube from September 9 to October 31. Call (617) 253-4680 for exhibit hours. *Technology Review* plans to carry a full obituary in the January issue.

Diane T. Georgopoulos, MAR '82, writes: "I was recently promoted in my department and will continue working on projects including the Elder Choice program, which is elderly housing with services, and the Demonstration Deposition Program, a special pilot program of HUD Section 8 assisted properties scheduled for rehabilitation and sale. The 1900 units are in Roxbury and North Dorchester, Mass." . . . From Orlando, Fla., C.T. Hsu, MAA '76, reports: "C.T. Hsu & Associates is celebrating 10 years of providing professional architectural, planning, and interior design services in Central Florida. Our sister company, Florida Crown Investment Co., is doing very well in real estate investment and development. C.T. Hsu International, Inc., was formed in 1992 to provide planning, consulting, and design services for theme parks, resorts, and attractions around the world."

David D. Wallace, '52, MAR '56, founder and principal of Wallace, Floyd, Associates, Inc., has been accepted to the AIA's College of Fellows. The college jury considers nominations from members with at least 10 years of continuous membership and who have made signifi-

cant contributions to the profession. Wallace's 35 years of professional practice has focused on the design of public projects from building to regional scale. He has had significant roles on such Boston city and regional planning and design projects as: Boston's \$7.7 billion highway improvement project, the Central Artery/Tunnel Project since 1972; new air rescue and fire-fighting facilities at Logan International Airport, which are currently under construction; the North Station Transportation Improvements Project involving the design of interim and new transit facilities; the Boston Naval Shipyard Land Use and Transportation Study, which reviewed reuse options after the shipyard was declared in excess; and work for the Boston Transportation Planning Review, which was the basis for new state policy programs directing the transit and commuter rail service expansion over highways within Metropolitan Boston. Wallace has been a member of the Boston Society of Architects and has served on the Urban Design Committee from 1957 to 1970, leading the committee as chair from 1968 to 1970. He has been a guest lecturer, panel member, and design juror at MIT and several other New England institutions.

V CHEMISTRY

From Northampton, Mass., Petra N. Turowski, PhD '90, writes: "I have been an assistant professor in the Department of Chemistry and in the program of biochemistry at Smith College since 1992. I am an adjunct assistant professor in the Molecular and Cellular Biology Program at UMass. I own two horses and show them in the summer when my teaching schedule is less hectic." . . . Gilberto M. (Ybet) Villacorta, PhD '87, sends word: "After spending six years as a law clerk/associate at Pennie & Edmonds in NYC, I have been a partner at the law firm of Oblon, Spivak, et al. in Arlington Va., since June 1993. My practice areas in patent law span a broad range of technologies, thanks to my MIT experience and prior corporate research experience at AT&T Bell Laboratories, and include biochemistry, biotechnology, chemistry, and materials science. My wife, Julia, and I, and our two children, Amelia, 7, and Natalie, 3, reside in McLean, Va., and we invite our friends and former colleagues to look us up when they are in the Washington, D.C. area. My work number is (703) 413-3000."

Thomas E. Lesslie, PhD '49, of Charlotte, N.C., died on May 10, 1994. The WWII veteran worked in research chemistry and from 1975 until his retirement was a chemical consultant. . . . The Association of Alumni and Alumnae has been notified that Lynwood O. Eikrem, SM '48, of Santa Clarita, Calif., died on October 8, 1992. There was no further information provided.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Jonathan J. Sirota, SM '64, has been named VP of Brooktrout Technology, Inc., in Needham, Mass. Previously, Sirota served as president of JOMA, Inc. . . . Two MIT alums have

been nominated to the National Academy of Engineering. Paul Kaminski, SM '66 (VI, XVI), CEO of Technology Strategies and Alliances, Va., was elected for his contributions to stealth technology and military systems. John Kassakian, '65, SM '67, EE '67, ScD '73, Course VI professor and director of its Laboratory for Electromagnetic and Electronic Systems, was also elected to the NAE. Kassakian also serves as a member of Sheldahl, Inc.'s board of directors in Minneapolis, Minn. . . . Robert



Robert Mitchell

Systems at the University of Texas-Arlington. Mitchell joined the University of Texas faculty in 1988 as professor and chairman of electrical engineering. Prior to joining the faculty at Arlington, Mitchell was at Purdue University in Lafayette, Ind., beginning as an assistant. From 1985 through 1988, he was Purdue's assistant dean of engineering for industrial relations and industrial research. Mitchell's research interests are in the area of computer vision and image processing systems with emphasis on manufacturing productivity.

Douglas T. Ross, SM '54, the founder and chairman of SofTech, resigned from the board of directors last April with the honorary title of founder and chairman emeritus. Ross founded SofTech in 1969 and has been chairman since 1991. He was the company's president from 1969 to 1975, chairman from 1975 to 1990, and chairman emeritus from 1990 to 1991. Until his official retirement at the end of 1994, Ross will continue his work on launching the next evolution of Structured Analysis, which he originated in the early 1970's. Ross, a Course VI lecturer, is credited with the creation of SofTech's Structured Analysis and Design Technique (SADT). The 1993 IDEFO Federal Information Processing Standard FIPS 183, derived from SADT, is widely used in manufacturing systems and business reengineering, both commercially and



C.L. Liu

in government. Ross also originated the International Standard APT language for programming machine tools while at MIT. . . . Chung

Mitchell, SM '68, EE '69, PhD '72, past chairman of electrical engineering at the University of Texas at Arlington, has been named dean of the University of Missouri-Rolla School of Engineering. Mitchell also served as the director of the NSF Center for Advanced Electron Devices and

Systems at the University of Texas-Arlington. Mitchell joined the University of Texas faculty in 1988 as professor and chairman of electrical engineering. Prior to joining the faculty at Arlington, Mitchell was at Purdue University in Lafayette, Ind., beginning as an assistant. From 1985 through 1988, he was Purdue's assistant dean of engineering for industrial relations and industrial research. Mitchell's research interests are in the area of computer vision and image processing systems with emphasis on manufacturing productivity.

Laung (C.L.) Liu, SM '60, EE '60, ScD '62, professor of computer science at the University of Illinois at Urbana-Champaign, was honored by the IEEE with the IEEE Edu-

CourseNews

computer science and system theory. "Liu's pioneering effort in bringing discrete mathematics into the undergraduate curriculum has had a profound impact on computer science education," states an IEEE news release. He is the author of many textbooks, including *Introduction of Combinatorial Mathematics* and *Elements of Discrete Mathematics*. Liu has received many educational awards, including the Taylor L. Booth Education Award from the IEEE and the Karl B. Karlstrom Education Award from the Association for Computing Machinery.

John V. Gutttag, Course VI professor, has been elected to the board of directors at Revco D.S., Inc., in Twinsburg, Ohio. Since his arrival at MIT in 1979, Gutttag has headed the Laboratory for Computer Science's Systematic Program Development Group. He is Course VI associate department head and has worked as a consultant, specializing in the analysis of software-related business risks and opportunities for a number of investment and venture capital organizations. He has also served on advisory committees for the DOD, the NSF, and the National Research Council.

Michael A. Guerra, SM '69 (VIII), PhD '76, of Exeter, N.H., died on May 21, 1994. Guerra was founder and CEO of Ibis Technology Corp. in Danvers, Mass. Prior to founding Ibis in 1987, he was a senior scientist at Rowland Institute for Science in Cambridge and director of R&D in the semiconductor equipment division of Eaton Corp. in Beverly, Mass. . . . Commander John M. O'Connell, SM '58, died on May 18, 1994. O'Connell, a Coast Guard captain, retired in 1979 as chief of the Aids to Navigation Division of the Office of Marine Environment and Systems at Coast Guard headquarters in Washington. He served in the Navy after WWII. His Coast Guard career included duty aboard various cutters, and he specialized in navigation-related R&D. He was commanding officer of the field testing development center in Baltimore and of the Coast Guard R&D center in Groton, Conn. His decorations included a Meritorious Service Medal, Coast Guard Commendation Medal, and Coast Guard Achievement Medal. In 1979, he received a Superior Achievement Award from the Institute of Navigation. . . . The Association of Alumni and Alumnae has been notified of the following deaths: Brigadier General John E. Kelsey, SM '48, of Cocoa Beach, Fla., on April 13, 1993, and Robert W. Beatty, SM '43, of Boulder City, Nev., on November 25, 1993. There was no further information provided.

VI-A INTERNSHIP PROGRAM

I'm writing in mid-June for this issue's column. Our first week of the "hot & humids" has brought 97°F at Lincoln Labs and 94°F at Logan Airport. Prior to this, it was cool and comfortable for our Technology Day activities. More on several of our T-Day VI-A visitors later in the column.

The EECS Department held its annual May Awards Social, again in the Great Hall of Faneuil Hall Marketplace. It is with a great

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deal of pleasure that I report that Francis Reintjes and your correspondent, John A. Tucker, were presented Department Head Special Recognition Awards by Department Head Paul L. Penfield, Jr., ScD '60. Reintjes was cited for serving, though retired, as acting VI-A director for the academic year 1993-94, following the retirement last September of Director Kevin J. O'Toole, SM '57, NE '57 (XIII). I was cited for my numerous administrative positions and Institute awards during 38 years with the department, including 18 as VI-A director, and continuing for the past five years, after retirement, in various supportive departmental activities as VI-A director (emeritus) and lecturer. Yours truly was taken quite by surprise at being called to the lectern and given the presentation. I had presumed I was "beyond the days of more awards."

The end of each college year has seen many academic awards going to VI-A students. Since this is essentially an alumni/ae report, I'll merely mention the awards that included VI-A students, listing only graduates by name. The Eta Kappa Nu honorary initiated 82 EECS juniors and seniors, of whom 35 were VI-As (41 percent). Of the 40 students taken into the Institute's Phi Beta Kappa chapter, 5 were VI-As. Of 99 School of Engineering students initiated into the National Engineering Honorary, Tau Beta Pi, 29 were VI-As (29 percent of the total). Congratulations to all of them who maintained the tradition of VI-As continuing to make an excellent showing among our top-performing students.

Among other honors and awards received by VI-A graduate students, as listed in this year's Commencement Bulletin, we note: John R. Buck, '89 (VI, XXI), SM '91, EE '92, received the Goodwin Medal "in recognition of conspicuously effective teaching by a graduate student"; Mark G. Duggan, '92, SM '94, and David R. Shoemaker, '92, SM '92, received the Frederick C. Hennie III Teaching Awards for excellence in teaching (named after Frederick C. Hennie III, '55, SM '58, ScD '61); and Alfredo M. Basas, '94, SM '94, David N. Coore, '94, SM '94, and David A. Lippe, '94 (VI, VIII), SM '94, received Morris J. Levin Memorial Awards for "outstanding oral thesis presentations in the Master of Engineering Program." . . . Winner of the prestigious Bose Foundation Fellowship for 1994 is VI-A graduate student Brian M. Scassellati. This annual award goes to the student who best demonstrates outstanding accomplishment and initiative and is selected by a panel from the Bose Corp.

Although I did not get to this year's Technology Day luncheon, several VI-A alums came by for afternoon visits. I had a nice long chat with Holton E. Harris, '44, SM '48, and John R. Selin, '70, SM '70, who stopped by together. Holton was a lifelong friend of Professor Karl L. Wildes, SM '22 (XVIII), who assisted Professor William H. Timbie in running Course VI-A in its early days, and who co-wrote the book *A Century of Electrical Engineering & Computer Science at MIT, 1882-1982* along with Nilo A. Lindgren, '48. Holton and wife drove up from Westport, Conn., for the day. I became closely acquainted with Holton through Karl and have remained in contact as Holton's son, Walter D. Harris, '86, SM '87, was later a student. Selin, a long-time employee of the Raytheon Co., has had VI-A students working for him and helped coordinate the program over the

years with their faculty advisor, Paul Penfield.

At MIT's graduation reception I met and had a short chat with Whay C. Lee, '82 (VI, XIV), SM '83, EE '86, PhD '89, who was there to see his brother, Whay S. Lee, '92, SM '94, graduate. . . . And passing through on her way to meet with President Vest was Denise D. Denton, '82, SM '82, EE '83, PhD '87, a member of the board of education of the National Research Council, and a tenured professor of electrical and computer engineering at the University of Wisconsin at Madison. She has just been awarded the C. Holmes MacDonald 1993 Outstanding Teaching Award by the Eta Kappa Nu Association in a national competition.

Not a VI-A grad, but a Course VI-er with whom I had contact prior to my VI-A days, was visitor Jeremy K. Raines, '69, PhD '74, from Rockville, Md. Jerry was president of the Eta Kappa Nu Chapter in '69 when I was faculty advisor. He stayed over after T-Day and took Lydia, my assistant, and me to lunch. We had a great time reminiscing about "the good ol' days." He and I are punsters and we used to open HKN officers' meeting with a run of puns!

Professor Reintjes shared with me an e-mail message he received from Paul M. Anderson, '91, SM '91, who is with Motorola in Austin, Tex. Paul comments he's spending time learning various Ethernet implementation issues in comparison to the circuit and analog work he did at MIT and how "I'd love to get my hands back on a few transistors."

I remind you of my e-mail address, below, if you have any news of alumni/ae interest you wish to communicate. I greatly enjoy hearing from all my past acquaintances and I intend to keep writing for the department awhile longer.—John A. Tucker, director (emeritus), VI-A Program, MIT, Room 38-473, Cambridge, MA 02139-4307; e-mail: <jat@fenchurch.mit.edu>.

VIII PHYSICS

John A. Serri, PhD '80, writes: "I am a project manager on a satellite communication system that will provide world-wide coverage for mobile telephone services. This work is being done at Loral and is called Globalstar." . . . George J. Raff, SM '71, SM '75 (XV), reports: "I recently moved from Cambridge to Los Angeles. Since Sloan, I've been doing bank operations consulting. Now, I'm practicing what I preach at First Interstate Bank of California." . . . C. Bruce Tarter, '61, has been named acting director of Lawrence Livermore National Laboratory in Livermore, Calif., until December 31, 1994, or until a permanent director is named. The University of California manages the lab for the DOE. Tarter has 27 years of experience at Livermore, beginning as a staff scientist in 1967. Last January he was named deputy director, the second-highest ranking position at the lab. Tarter has been associate director for physical sciences, associate director for physics, deputy associate director for physics, and division leader in theoretical physics.

J. Ed White, PhD '49, was recently featured as the June 1994 cover story subject of *The Leading Edge*, published by the Society for Exploration Geophysicists (SEG). The former president of SEG was commended for a career

that included "lecturing in five continents, serving as a delegate of the U.S. State Department for the 1965 geophysics exchange with the USSR, spending an academic year also in the Soviet Union on an exchange between the two countries' Academy of Sciences, and for being a consultant for the World Bank-financed Chinese University Development Project." White is the author of the textbooks *Seismic Waves: Radiation, Transmission, and Attenuation* and *Underground Sound*. The latter has been translated into Russian and Chinese. The article discusses White's 23 patents, his various jobs from industry to academia and ultimately how, in 1967, he was named first holder of the Charles Henry Green Chair of Exploration Geophysics at the Colorado School of Mines. Now professor emeritus and working on ideas at his office in Mines, White has received honors from the NAE, CSM, the Acoustical Society of America,



Robert Laughlin

and SEG, which gave him its highest award, the Maurice Ewing Medal, in 1986. . . . **Robert B. Laughlin**, PhD '79, a professor of physics and an Anne T. and Robert M. Bass Professor in the School of Humanities and Sciences at Stanford, has been elected to the National Academy of Sciences. He is recognized as one of the top theorists in the field of condensed matter physics, the study of the physical properties of solid materials. Laughlin, who joined Stanford in 1984, provided one of the first general theoretical explanations of the quantum Hall effect, which involved the motion of electrons in metals or semiconductors in the presence of both electric and magnetic fields. When cooled to very low temperatures, electrical conductivity in one direction becomes quantized, that is, begins to jump between different discrete values. For his explanation of this and related effects, he was awarded the 1985 E.O. Lawrence Award for Physics, as well as the 1986 Oliver E. Buckley Condensed Matter Prize, the most prestigious award in condensed matter physics in this country. Recently, Laughlin has been working on an original theory to explain the newly discovered high-temperature superconductors, materials that can conduct electricity at much higher temperatures than traditional superconductors. Among other honors, Laughlin was elected to the AAAS in 1990.

Michael A. Guerra, SM '69, PhD '76 (VI), of Exeter, N.H., died on May 21, 1994. Guerra was founder and CEO of Ibis Technology Corp. in Danvers, Mass. Prior to founding Ibis in 1987, he was a senior scientist at Rowland Institute for Science in Cambridge and director of R&D in the semiconductor equipment division of Eaton Corp. in Beverly, Mass.

X CHEMICAL ENGINEERING

Irwin J. Gruverman, SM '55, has been named director of a FiberChem, Inc., in Las Vegas, Nev. He continues as chairman and CEO at Microfluidics Corp. in Newton, Mass., and

chairman of the board of Invitro International, which is developing replacements for animal tests in cosmetics, waste, drugs, etc.



Yi Hua (Ed) Ma

Ma served as head of the Chemical Engineering Department from 1979 to 1989. Ma was cited for "his outstanding contributions to the understanding of the fundamentals of adsorption and diffusion of gases in microporous media and the preparation of new types of composite membranes, and for adding to our knowledge of the process of adsorption and permeation of single components and mixtures, which occur in these new materials." The citation goes on to read, "Through his research he has developed a comprehensive database leading to descriptive models now used to design and operate adsorptive systems. His work toward developing an effective membrane reactor has demonstrated not only a command of materials science and chemical engineering principles, but also the ability to integrate them into a workable, multifunctional system for improved chemical reaction processing."

The Association of Alumni and Alumnae has been notified that **Marshall Ballard, Jr.**, '35, of New Orleans, La., died on September 9, 1993. There was no further information provided.

X-A PRACTICE SCHOOL

With Commencement over, most of the campus as this is written has gone into its near-somnolent mood of summer. But the events of May 27 are far from forgotten at SCEP, whose alumni/ae swept the 1993-94 Course X awards for graduate students and claimed the usual number of master's degrees in Killian Court.

Four of the five Special Service Awards from the department went to SCEP students and alumni/ae: **Joao Paulo Aumond**, G, **Matthew DiPippo**, SM '93, **Christopher Dowd**, SM '93, and **Nancy Zoeller**, SM '94. (Chris Dowd also carried off the Chemical Engineering "Rock" Award for fostering team spirit in departmental athletic activities.) Senior lecturer **C. Michael Mohr**, '55, SM '56, ScD '61, was chosen by Course X undergraduates for the Outstanding Faculty Award; he also received MIT's coveted Everett Moore Baker Memorial Award for excellence in undergraduate teaching. And **Lloyd Johnson** was runner-up for the

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department's **Edward W. Merrill** (ScD '47) Outstanding Teaching Assistant Award.

Here's what is now known about the plans of those who marched across the platform for SCEP degrees at Commencement: **Jane Ciebien**, SM '94, is continuing for her doctorate at MIT after serving as assistant director of the West Point Station (Merck) during the summer. **I-Ming Hsing**, SM '94, **Andre LeCesne**, SM '94, and **Haiyan Wu**, SM '94, are continuing in Cambridge for doctorates. **Joshua Levinson**, SM '94, is now a graduate student at Stanford.

Five SCEP alumni/ae received doctorates in chemical engineering at Commencement: **Ulrich Holeschovsky**, SM '92, PhD '94, is working at Arco in West Virginia; **Peter Kofinas**, '89, SM '89, PhD '94, is with Professor Edward W. Merrill at MIT as a post-doc. **Reza Mehrabi**, PhD '94, also plans a post-doc year—location not known at press time. **Rahul Singhvi**, SM '89, ScD '94, is working as a process engineer at Merck, Rahway, N.J., and **W. Gabriel Worley**, SM '89, PhD '94, is at press time still making future plans.

After a year's post-doc at MIT, **Paul Nealey**, PhD '94, will go to the University of Wisconsin as assistant professor in September 1995; he was assistant director of the West Point Station in the fall of 1991.

After graduating from SCEP as World War II began, **Cherry L. Emerson**, SM '41, went to work for Monsanto; later he and a Monsanto colleague began Emerson-Cuming, a successful chemical manufacturer that was the nation's first formulator of epoxy resins. After retirement four years ago in Atlanta, Emerson endowed a chair in chemistry at Emory University and later gave funds for Emory's Center for Scientific Computation, named in his honor. Emerson studied at Emory before entering MIT, and on May 9 he received a second degree from Emory—an honorary doctor of science. (Mrs. Emerson is the daughter of the late **Warren K. Lewis**, '05, one of the great figures in chemical engineering at MIT.)



Cherry L. Emerson, SM '41 (right), an alumnus and generous benefactor of Emory University, receives Emory's honorary doctor of science degree at commencement exercises on May 9, 1994.

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Michael J. Abadi, SM '78, moved from Boca Raton to Philadelphia during the summer to continue with Ivax Industries in its new corporate headquarters. Abadi is (since 1992) business development manager, responsible for mergers and acquisitions—including acquisitions of new technology—and for overall coordination of international activities. . . . From Barrytown, N.Y., David E. Borenstein, '54, writes, "Toward the end of my 37 years in synthetic fibers research and development, I became manager of staple fibers R&D for a major fibers company. I took early retirement this year and am now doing consulting in synthetic fibers manufacturing."

Two recent SCEP alumni successfully defended their doctoral theses at MIT in June and received their degrees at the end of the summer. Paschalis Alexandridis, SM '90, PhD '94, is a post-doc at Lund University, Sweden, and Timothy Dalton, SM '90, PhD '94, is now a senior manufacturing engineer at Digital Equipment Corp., Hudson, Mass., where his assignment is plasma diagnostics for a newly constructed wafer fabrication facility. . . . Robert J. Juba, Jr., '92, SM '93, reports that he is working at Merck, West Point, Pa., where his assignment is the same as it was as a PS student—a validation scientist providing support for biological products. While at the West Point Station, Rob said he would never go back to Merck—surprise!

Correction: In our April issue we reported that the death of Perley Coffin, SM '33, occurred on November 3, 1993. The correct date was July 31, 1993. Our apologies.—John Mattill, *Technology Review*, Room W59-200, MIT, Cambridge, MA 02139. Or send news to Carol Phillips at the SCEP office, Room 66-309, MIT; or <carol@pracschool.mit.edu>.

XI URBAN STUDIES AND PLANNING

Victor Hoskins, MCP '81, sends word from Los Angeles: "In mid-June, I resigned as president of the Community Partnership in Long Beach, Calif., to become the director of technology at the Greater Baltimore Committee in Maryland. In this position, I will be responsible for creating an economic environment to grow, attract, and retain biotech, life-science, and high-tech companies in the six counties in the greater Baltimore region. This will be achieved through the marketing of tax-incentive, financial-incentive, and technology-transfer programs." . . . Sheryl L. Handler, PhD '85, has resigned as chair of Thinking Machines Corp. in Cambridge. She is involved in setting up a new venture. . . . Glen Weisbrod, SM '78 (I, XI), has left Cambridge Systematics after 15 years, to head the Boston office of HBRS, Inc. In his new position, he is focusing on economic impact analysis and energy planning. . . . Adriana N. Stadecker, MCP '73, PhD '76, has been named a director at Genrad, Inc., in Concord, Mass. Stadecker continues as VP for executive operations at DEC in Maynard, Mass. At DEC she is responsible for the management of cross-functional teams chartered with the development of strategic and operational plans in support of Digital's future vision. Prior to this assignment, she was group human resources manager of worldwide manufacturing logistics, from

1991 to 1992 where she established the long-range planning that led to the redesign and implementation of a customer-driven supply and delivery system. . . . Celeste Alicia Beron, MCP '70, has been named an attorney at the



Celeste Beron

law firm of Petree Stockton in Winston-Salem, N.C. Beron works in the area of real estate and commercial lending. Prior to this position, she was VP and attorney for Wachovia Bank, also in Winston-Salem, and had served as chair of the board of the Harvard University Employees Credit Union. . . . Last

April, Sylvia Watts McKinney, MCP '83, was named director of the Museum of Afro American History/African Meeting House set on Boston's Beacon Hill. The museum, which operated for one year without a director, hired McKinney to help rethink its role. It plans to extend its board member base from 17 to 27, increase and broaden the funding base, and eventually open up a meeting house discovered on Nantucket that may be the second-oldest standing black church in America after Boston's meeting house, which was built in 1806. The museum recently won a \$5,000 grant from a California foundation for the house restoration. McKinney is a former chief of staff at the Massachusetts Executive Office of Transportation and Construction, a state agency that oversees 17 authorities, including the Massachusetts Bay Transportation Authority and the Massachusetts Port Authority. She was senior budget and policy analyst for the state Executive Office of Administration and Finance's budget bureau in Boston. And she was VP for development at Taylor Properties, a real estate development company that specialized in affordable housing and commercial development for Boston and Cambridge.

XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

From Aldergrove, British Columbia, Francis B. Whiting, PhD '51, sends us a list of his affiliations: "I am president & director of the following organizations: Marmot Enterprises, Ltd. (real estate developers), Braymont Utilities, Ltd. (water service utility), Whiting Mining Services International, Ltd. (geological consultants), and Rosalie Resources, Ltd. (mining exploration company). And I'm a director at White Knight Resources, Ltd. (junior V.S.E. mining company) and Marina Shellfish, Ltd. (clam harvesting company)." . . . Jack Wisdom, Course XII professor, has been named a 1994 MacArthur Fellow. Over the next five years, Wisdom will receive \$260,000 for his work on the movements of the solar system.

The Association of Alumni and Alumnae has been notified that William Parrish, PhD '40, of San Jose, Calif., died on March 18, 1991. There was no further information provided.

XIII

OCEAN ENGINEERING

Rolf Dietrich, SM '79 (II, XIII), sends word from Canfield, Ohio: "I am commanding officer of the nuclear-powered submarine, USS *Sturgeon*, defueling in Puget Sound Naval Shipyard. I'm completing service with the Navy on September 1, 1994, and will be making the transition to an as yet undecided civilian career in engineering management." . . . Navy Lieutenant Commander Elizabeth A. Rowe, SM '88, has recently graduated from the Naval War College. During the 10-month course, which is taught at the Naval War College in Newport, R.I., students take postgraduate courses in strategy and policy, national security decision-making, and joint military operations. Rowe joined the Navy in 1980. . . . Navy Lieutenant Matthew L. Johnson, OCE '93, recently graduated from the Submarine Officer Advanced Course with honors. During the course at the Naval Submarine School in Groton, Conn., students receive instruction in submarine warfare, tactical proficiency, and naval warfare publications pertaining to submarine warfare. Johnson joined the Navy in 1981.

XIV

ECONOMICS

Irwin L. Collier, Jr., PhD '84, writes: "I accepted a professorship in economics at the Free University of Berlin, Germany, that began June 1, 1994." . . . Richard M. Bookstaber, PhD '77, has been named a senior operating officer at Salomon, Inc., in New York, N.Y. He was previously at Morgan Stanley Group, Inc., also in New York City. . . . Course XIV professor Paul Krugman, PhD '77, has been active in the publishing world. He has a new book entitled *Peddling Prosperity: Economic Sense and Nonsense in the Age of Diminished Expectations* (W.W. Norton). He also had an article in *Foreign Affairs*, entitled "Competitiveness: A Dangerous Obsession," and another article in the April issue of *Scientific American*, entitled "Trade, Jobs, and Wages," which he wrote with Harvard economist Robert Z. Lawrence. He also has articles due in *Harvard Business Review* and *Foreign Policy*. . . . Sheldon Friedman, '70, Richard W. Hurd, Rudolph A. Oswald, and Ronald L. Seeber are the editors of *Restoring The Promise Of American Labor Law* (ILR Press, 1994). The book illustrates the importance of labor laws, particularly for minorities and women who are still struggling for economic justice.

Captain James S. Shilson, SM '42, USN (ret.), of Seattle, Wash., died on April 29, 1994. Shilson participated in several Pacific WWII engagements, highlighted by those at Midway, Santa Cruz, and Guadalcanal. Following a short tour at Pearl Harbor, he joined the staff of the Central Pacific Command and participated in the softening up of the Japanese-held mid-Pacific Islands preparatory to final assault. Following the war years, he had several desk jobs including the traditional Washington assignment; then ship commands, including individual, division, and ultimately

destroyer squadron command. In between there was a base command, a tour of duty as a student at the Army War College, and shore assignments in Japan, England, and The Philippines. Upon completion of 30 years of commissioned service and retirement in 1964 in Seattle, he was associated with a number of youth, handicapped, civic, and community groups. Among several associations, Shilson was a professional member of the American Meteorological Society and a charter member of the Army War College Alumni Association. Shilson received several awards including the Presidential Unit Citation, the Pacific Campaign Ribbon with Nine Battle Stars, and the Order of the Sacred Treasure (bestowed by the Emperor of Japan).

XV

MANAGEMENT

James A. F. Stoner, SM '61, PhD '67, writes: "I am on a two-year leave from Fordham University's Graduate School of Business. Recently, I have been studying how leading quality companies are changing their financial management practices—including controllership and auditing. I co-wrote *Finance in the Quality Revolution and Managing Finance for Quality*. The sixth edition of my management text will be published this fall."

From Camden, Australia, Doug Dodds, SM '58, sends word: "We have had a wonderful visit from Clint Jones, SM '58, and Ellen, his wife, as part of their six-week tour of Australia and New Zealand. They brought us gifts from the Tech Store (of fond remembrance) which were greatly appreciated. Clint and Ellen gave us news of their six-week tour of Australia and New Zealand. They gave us news of the Institute and Boston and we were able to show them sights of Sydney and area. We would welcome any MIT people who come this way."

George J. Raff, SM '71 (VIII), SM '75, reports: "I recently moved from Cambridge to Los Angeles. Since Sloan, I've been doing bank operations consulting. Now I'm practicing what I preach at First Interstate Bank of California."

Michelle S. Wolf, SM '88, writes: I joined the law firm of McDermott, Will & Emery and am working in the Boston office's Health Law Department."

Robert A. Schmitz, SM '65, has been named managing director of special placements at Trust Co. of the West (TCW). Prior to joining TCW in 1993 as a senior partner, Schmitz was an independent consultant developing special investment opportunities for a joint-venture affiliate of Soros Fund Management. Previously, he served as VP of Dow Jones & Co. and chair and CEO of its Richard D. Irwin book-publishing subsidiary. Schmitz was formerly a principal at the consulting firm McKinsey & Co., where he was responsible for the firm's corporate financial strategy practice.

James J. Forese, SM '59, joined Alco's board of directors. Forese is an IBM VP, chairman of the IBM Credit Corp., and a member of IBM's Worldwide Management Council. He serves on the boards of directors of several corporations, including IBM Latin America and American Management Systems.

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The Association of Alumni and Alumnae has been notified that **Francis M. Gaughan**, SM '71, of Dublin, Ireland, died in 1994. No further information was provided.

SLOAN FELLOWS

William R. Thompson, SM '75, sends word from Cape Coral, Fla.: "My wife, JoAnn, has retired from IBM after 30 years. We have built a new home on the water in Southwest Florida, and can fish off our dock. We're playing tennis almost everyday and we travel several months per year. We absolutely love it! Please call and stop by if you are in the area." . . . **Frederick F. Sommer**, SM '80, has been named CEO and a director of Automotive Industries Holding, Inc., in Troy, N.Y. He continues as president of the company. . . . **Philip M. Condit**, SM '75, has been named a director of Nordstrom, Inc., in Seattle, Wash. He continues as president of Boeing, also in Seattle.

John F. Fiedler, SM '79, has resigned as executive VP of North American Tires at Goodyear Tire and Rubber Co., in Akron, Ohio, "to pursue other interests."

John D. Stubbs, SM '71, of Bermuda, died on June 7, 1994. Stubbs was a practicing general surgeon, a founder of the United Bermuda Party, a frequently elected member of the government, and several times a minister with various portfolios. An ardent advocate of integration and civil rights, Stubbs long worked to help make Bermuda an effective example of multiracial society. As his last political act, Stubbs introduced a bill that removed sexual orientation as an actionable offense in Bermuda, a struggle on a matter of principle that was successfully adopted just prior to his death from cancer. He also served on the board of director of Management Sciences for Health, the organization founded by **Ron O'Connor**, SM '71.

Thomas D. Rowan, Jr., SM '61, of Saint Paul, Minn., died on May 10, 1994. Rowan joined Engineering Research Associates in 1950, at that time one of the few companies developing the concept of computers. An expert on vacuum tubes before the days of microchips, Rowan tried to solve the problems associated with data storage. This company later became Univac, a division of Remington Rand. In 1962 he joined several colleagues at Control Data, where he worked until he retired in 1985. Rowan served in the Navy for seven years. He was a radio operator and received a medal for tracking an enemy submarine during WWII. . . . The Association of Alumni and Alumnae has been notified that **Paul H. Rosenberg**, '52, of Chicago, died on May 7, 1994. No further information was provided.

SENIOR EXECUTIVES

William H. Oliver, '84, has been named VP for corporate public relations at AT&T Corp. in Basking Ridge, N.J. Previously, Oliver was VP of TRW, Inc., in Cleveland, Ohio. . . . **Edward J. Mooney**, '79, is CEO and president of Nalco Chemical Co. in Naperville, Ill. He was president and COO at Nalco Chemical Corp. prior to this. . . . **William M. Steul**, '82, has resigned as CFO at Digital Equipment Corp. in Maynard, Mass.

Heiner Wilkens, '84, has been appointed

senior VP for Europe, the Middle East, and Africa at Pratt & Whitney. Wilkens joins the commercial engine business after a distinguished 28-year career at Lufthansa, where he most recently served as senior VP for purchasing and material. In his new post, Wilkens will lead all of Pratt & Whitney's commercial engine sales, marketing, and business activities in these countries and he will also serve as the company's senior executive for product and service issues in those regions. Wilkens is a resident of Hamburg, Germany.

The Association of Alumni and Alumnae has been notified of the following deaths: **Robert R. Todd**, '85, of Birmingham, Ala., on May 9, 1994, and **Henry J. Hughes**, '59, of Fairfield, Conn., in 1992. No further information was provided.

MANAGEMENT OF TECHNOLOGY

Yasuhito Hayashi, SM '93, visited the MOT program office in June to meet with Rochelle Weichman. Yasuhito has recently been promoted to manager in the Service Planning Department at Nippon Telegraph and Telephone Corp. in Japan. He is in charge of strategic alliance with multimedia-related companies. He enjoys his new job and using what he learned at MIT.

Makoto Ishizuka, SM '93, also visited Rochelle. He was in the U.S. to meet with MCA (owned by Matsushita) to discuss joint technical development. As the general manager of the corporate planning office at Matsushita Research Institute Tokyo, Inc., of Kawasaki, Japan, Makoto also has the difficult job of encouraging 200 research engineers to refocus their efforts on new, state-of-the-art technologies.

Francis Yeoh, SM '93, informed the MOT office that he has returned from a business visit to see **Sigmund Kvernes**, SM '93, in Trondheim, Norway. During the week there, Francis was able to catch up with Sigmund and his family as well as enjoy some skiing. Evidently, Sigmund and his wife, Anne, will be visiting Singapore in 1995 and Francis looks forward to his turn showing them the sites. While in Europe, Francis also visited **Emmanuel Henry**, SM '93, at Matra-CAP Systemes in Paris. Emmanuel is fine and expecting baby number two!—MOT Program, MIT, Room E56-290, Cambridge, MA 02139.

XVI AERONAUTICS AND ASTRONAUTICS

Paul Kaminski, SM '66 (VI, XVI), CEO of Technology Strategies and Alliances, Va., was elected to the National Academy of Engineering for his contributions to stealth technology and military systems.

In June, NASA astronaut **Janice Voss Ford**, SM '77 (VI), PhD '87, spoke to the MIT Club of South Texas about using space as a platform for analyzing the environment of Earth. She presented slides showing the impact of both natural and human-made events such as volcanoes, storms, deforestation, and the Kuwaiti oil fires. She discussed her future plans, which include training to fly on the NASA mission that will rendezvous with the

Russian Space Station, Mir, in early 1995. Ford will again be a mission payload specialist in Spacehab, a laboratory compartment that fits in the shuttle payload bay.

Colonel Richard M. Gill, '41, of Colorado Springs, Colorado, died on March 23, 1994. He served in the Air Force from 1943 to 1973. Gill, who lived in Colorado, Alaska, New York City, Washington, D.C., and Germany, had been a meteorologist for television station KRDO.

XVII POLITICAL SCIENCE

Dana G. Mead, PhD '67, has been named to the board of directors at Alco Standard Corp. in Valley Forge, Pa. Mead is president and CEO of Tenneco, Inc., and is chairman and CEO of Case Corp. He was formerly executive VP and director of International Paper. He serves on the board of directors of National Westminster Bancorp, Cummins Engine Co., and Baker Hughes, Inc., and on the executive committee of the American Society of Corporate Executives, the Council on Foreign Relations, and the President's Commission on White House Fellowships, and is a trustee-at-large for the Association of Graduates, U.S. Military Academy, West Point. He is also a member of the MIT Corporation Political Science Visiting Committee.

Anthony F. Balzebre, '51, sends word from Coral Gables, Fla.: "After retiring from wholesale lumber and architectural millwork business, I have spent the last 25 years in real estate development throughout the Gulf states—Alabama, Texas, Louisiana, Florida, etc. I'm semi-retired and I've the best of both worlds: summer in Hyannisport, Mass., winters in Coral Gables. I've been married for 40 years to Dorothy Pillsbury Wingate and we've six children: Anthony, Jr., Richard, Robert, Thomas, Janet, and Susan. Four are married and have given us seven wonderful grandchildren."

XVIII MATHEMATICS

Benjamin Kuipers, PhD '77, writes: "I am living happily in Austin, Tex., with my wife and three children. I am a professor in the Computer Science Department at the University of Texas, doing research in AI. My book, *Qualitative Reasoning*, is due to be published this summer by MIT Press."

Shirley A. Wilson, '72, associate professor of mathematics at North Central College in Naperville, Ill., received the \$2,500 Clarence F. Dissinger Memorial Award for distinguished teaching and service by a senior faculty member. Described by her nominators as "a teacher who expects the most of her students" but who "always has time for them," and "the backbone of the math department," she has been active in curriculum reform on campus and has served as faculty speaker and chairperson of the Mathematics Department. This past September, she assumed the position of associate academic dean.

XX APPLIED BIOLOGICAL SCIENCES

Charles Bates, PhD '57, writes: "I'm retired and enjoying life. I am Boy Scout Council Commissioner and I do some consulting." . . . Spiros Jamas, SM '83, ScD '87, has been named a director of Middlesex Sciences, Inc., in Foxboro, Mass. He continues as president and CEO at Alpha-Beta Technology, Inc., in Worcester, Mass.

XXII NUCLEAR ENGINEERING

Lieutenant Lorin Selby, SM '93, NUE '93, writes: "After graduation, I spent two weeks in Europe with fellow graduate, Tim Lawrence, SM '93. We had a blast visiting Germany, France, Switzerland, Italy, Austria, and the Czech Republic. Upon returning to the States, I attended a six-month school for the Navy (submarine officer advanced course) in Groton, Conn. In January, I reported as navigator and operations officer to USS Pogy (SSN 647), a fast-attack nuclear submarine in San Diego, Calif.

From Potomac, Md. Frederick H. Hauck, SM '66, reports: "I'm president/CEO of International Technology Underwriters, a world leader in providing insurance for the risk of launching and operating satellites. In June 1993 I married Susan C. Bruce, who has kept her full name." . . . Major Michael R. Helmick, SM '88 (II, XXII), writes from Harker Heights, Tex.: "I moved from executive officer to the III Corps Operations Officer to operations officer for 91st Engineer Battalion, 1st Cavalry Division in Fort Hood, Tex. My wife, Gina, and I now have two children, Stephanie, 4, and Katherine, 1. In my current position, I am responsible for operations, plans, and training for the combat engineer battalion supporting the cavalry division Ready Brigade. The Ready Brigade is prepared to deploy to contingency theaters within 24-48 hours of notification."

Navy Commander Daniel R. Sigg, SM '79, recently assumed command with the submarine Precommissioning Unit Columbus, based in Groton, Conn. Sigg's previous tour of duty was as the assistant director of the Officer Training Department at the Naval Submarine School in New London, Conn. He has also served as executive officer of the fast attack submarine USS *Guitarro*. Among his personal awards and decorations are the Meritorious Service Medal, the Navy Commendation Medal, and the Navy "E" Battle Efficiency ribbon. He joined the Navy in 1977.

Ian A. Forbes, PhD '70, of Acton, Mass., died on May 21, 1994. An expert on energy management and the development of electronic cogeneration power facilities, he died in a boating accident in Maine. He was a cofounder and executive VP of Energy Research Group, Inc., in Waltham, Mass., and the Independent Energy Corp. of Hartford, Conn. He was also an assistant and associate professor at the University of Lowell from 1970 to 1975.

TPP TECHNOLOGY AND POLICY PROGRAM

Jessica Stern, SM '88, has received a Council on Foreign Relations Fellowship for 1994-95, which allows junior academics to go into government for a year. Jessica has been working on the security implications of inter-regional economic and ethnic tensions within Russia and would very much like to continue to work on these issues at the NSC. . . . Christophe Chazot, SM '91, has written a book entitled *Les Swaps Theorie et Applications*, published by Economica, and has joined the staff of Bankers Trust Equity Derivatives in England. . . . J. Steve Thomas, SM '92, is enjoying the multi-cultural environment of working with French-German co-workers at Dresdener Bank in Chicago, developing energy "swaps." Steve has also published several articles in *Energy Risk*. . . . Brian Cohen, SM '93 (I, TPP), has joined a small environmental advocacy group called the Environmental Working Group as an environmental engineer, and will be working on clean water and pesticides issues. . . . Luis Javier Mira, SM '72, has been elected president of the MIT/Harvard Club of Colombia for 1994-96. Luis is completing a book on engineering economy as a result of his classes at Universidad de Los Andes in Bogota. Also, he recently wrote two papers entitled "The Inventories Cost in Project Evaluation" and "Optimal Reposition Time for Obsolescent Equipment."—Richard de Neufville, TPP, MIT Room E40-252, Cambridge, MA 02139.

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

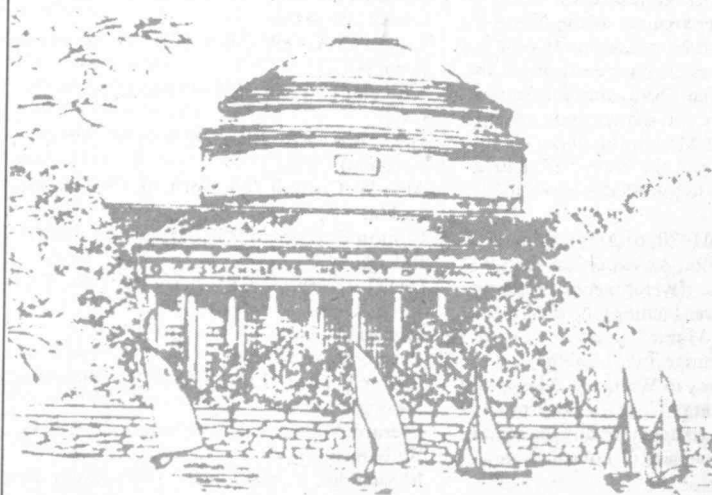
Harold Bugbee, '20; May 26, 1994; Woburn, Mass.
Victor N. Kruse, '22; March 12, 1994; Westfield, N.J.
Clift R. Richards, '22; June 9, 1994; Altoona, Fla.
Leonard E. Carlsmith, SM '23; April 11, 1994; Oak Ridge, Tenn.
Robert A. Hall, '23; March 28, 1994; Norwood, Mass.
Robert H. Park, '23; February 18, 1994
Julius A. Stratton, '23; SM '26; June 22, 1994; Cambridge, Mass.
Everett C. Atwell, '24; April 9, 1994; Greensboro, N.C.
Malcolm H. Finley, '24; 1994; San Rafael, Calif.
Helen B.P. O'Rourke, '24; May 18, 1994; Longwood, Fla.
Alan W. Crowell, '25; April 10, 1994; Sarasota, Fla.
Clinton B. Galphin, '26; January 10, 1994; Raleigh, N.C.
Peter J. Jerardi, '27; February 16, 1994; Trotwood, Ohio
Harland P. Sisk, '27; June 20, 1994; Yarmouth Port, Mass.
Arthur J. Tacy, '27; February 26, 1994; Westborough, Mass.
Everard M. Lester, '28; February 28, 1994; Williamsburg, Va.
Irl Sandidge, Jr., '28; July 25, 1989; Austin, Tex.

Arnold W. Ewan, '29; June 1, 1994; Muenchen, Germany
 Edward M. Pritchard, '30, SM '31, ScD '34; June 21, 1994; Pocasset, Mass.
 George Sutton, '30; January 3, 1994; Charlton, Mass.
 Joseph M. Buswell, '31; May 27, 1994; Sun City, Ariz.
 Warren T. Dickinson, '31; September 3, 1990; Los Angeles, Calif.
 Frank L. McKnight, '31; February 14, 1994; Gardner, Mass.
 Henry Fisher, SM '32; May 21, 1994; Berkhamsted, England
 Thomas G. Hannafin, '32; April 14, 1994; Lowell, Mass.
 Campbell C. Hyatt, Jr., '32; December 16, 1898; Kingsport, Tenn.
 George W. Muller, Jr., '32; January 1, 1994; Oak Harbor, Wash.
 Winthrop E. Robinson, '32; September 24, 1993; Iowa City, Iowa
 Ernesto De Sola, '33; September 10, 1993; Guatemala City, Guatemala
 John G. Brunner, '34; March 6, 1994; Newtown, Pa.
 Francis J. Dowling, '34; March 12, 1994; Meriden, Conn.
 Charles B. Gamble, Jr., '34; December 18, 1993; Birmingham, Ala.
 George E. Westefeld, '34; April 16, 1994; Cheshire, Conn.
 Marshall Ballard, Jr., '35; September 9, 1993; New Orleans, La.
 Henry J. Ogorzaly, '35, SM '36; May 21, 1994; Summit, N.J.
 Joseph S. Oldham, '35; March 20, 1994; Central Falls, R.I.

Charles Wheeler Coberly, SM '36; May 17, 1993; Pasadena, Calif.
 Abbott Byfield, '38, SM '39; May 22, 1994; Fort Myers, Fla.
 Walter F. Kaufman, '38; April 22, 1994; Selinsgrove, Pa.
 Grosvenor F. Powell, SM '38; February 1986; Sacramento, Calif.
 William Parrish, PhD '40; March 18, 1991; San Jose, Calif.
 Richard M. Gill, '41; March 23, 1994; Colorado Springs, Col.
 Hugh K. Spaulding, '41; May 20, 1994; Huntington, N.Y.
 Irving S. Fagerson, '42; June 3, 1994; Amherst, Mass.
 Gunner Orberg, '42; December 12, 1987; Sao Paulo, Brazil
 James S. Shilson, SM '42; April 29, 1994; Seattle, Wash.
 Robert W. Beatty, SM '43; November 25, 1993; Boulder City, Nev.
 James P. Robinson, '43; March 21, 1994; Lowell, Mass.
 John J. Ebersberger, '47; May 9, 1994; Albertson, N.Y.
 Robert B. Charney, '48; May 19, 1994; New York, N.Y.
 Lynwood O. Eikrem, SM '48; October 8, 1992; Santa Clarita, Calif.
 Peter A. Cuercio, '48, SM '50; April 28, 1994; Scarsdale, N.Y.
 John E. Kelsey, SM '48; April 13, 1993; Cocoa Beach, Fla.
 James A. Leonard, '48; May 30, 1994; Hingham, Mass.
 Thomas E. Lesslie, PhD '49; May 10, 1994; Charlotte, N.C.

Joseph H. McCusker, SM '49; June 1, 1994; Princeton, N.J.
 Harold D. Vitagliano, '49; May 2, 1994
 John V. Killheffer, Jr., '50; January 24, 1993; Somerset, Mass.
 Aaron Finerman, SM '51, ScD '57; April 6, 1994; Ann Arbor, Mich.
 Cooper R. McCarthy, '51; April 20, 1994
 Hugh A. Robinson, '52; June 18, 1994; Wenham, Mass.
 Paul H. Rosenberg, '52; May 7, 1994; Chicago, Ill.
 William Weaver, SM '52; April 28, 1994
 Paul J. Goldin, '54; May 21, 1994; Cherry Hill, N.J.
 Herman S. Jacobs, '55; SM '57; April 23, 1994; Palm Beach, Fla.
 David L. McBride, III, '56, ScD '62; December 29, 1993; Youngstown, Ohio
 John M. O'Connell, SM '58; May 18, 1994
 Henry J. Hughes, '59; 1991; Fairfield, Conn.
 Thomas D. Rowan, Jr., SM '61; May 10, 1994; Saint Paul, Minn.
 John W. Harris, '66; April 16, 1994; Bowie, Md.
 Ian A. Forbes, PhD '70; May 21, 1994; Acton, Mass.
 Francis M. Gaughan, SM '71; 1994; Dublin, Ireland
 Mario Rufo, '74, MAR '79; March 18, 1994; Newton, Mass.
 Michael A. Guerra, SM '69, PhD '76; May 21, 1994; Exeter, N.H.
 Mark D. Altbush, '78; May 13, 1994; Jamaica Plain, Mass.
 Lisa Sugerman, '84; February 2, 1994; Kaneohe, Hawaii
 Robert R. Todd, '85; May 9, 1994; Birmingham, Ala.

*Where might a
name best live?*



The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues or family. Memorial gifts can be unrestricted as to purpose or directed toward scholarships, research or any program of the Institute. The Institute notifies bereaved families of the name of each donor and each gift becomes a part of MIT's permanent record.

Named endowed funds whose income support the work of the Institute in perpetuity can be established with larger gifts. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617) 253-8059.

PuzzleCorner

Since this is the first issue of a new academic year, I once more review the ground rules under which this department is conducted.

In each issue I present three regular problems (the first of which is chess, bridge, go, or computer-related) and one "speed" problem. Readers are invited to submit solutions to the regular problems, and three issues later, one submitted solution is printed for each problem; I also list other readers who responded. For example, solutions to the problems you see below will appear in the February/March issue and this issue contains solutions to the problems posed in May/June. Since I must submit the February/March column in November, you should send your solutions to me during the next few weeks. Late solutions, as well as comments on published solutions, are acknowledged in subsequent issues in the "Other Respondents" section. Major corrections or additions to published solutions are sometimes printed in the "Better Late than Never" section as are solutions to previously unsolved problems.

For speed problems the procedure is quite different. Often whimsical, these problems should not be taken too seriously. If the proposer submits a solution with the problem, that solution appears at the end of the same column in which the problem is published. For example, the solution to this issue's speed problem is given below. Only rarely are comments on speed problems published.

There is also an annual problem, published in the January issue of each year; and sometimes I go back into history to republish problems that remained unsolved after their first appearance.

Problems

OCT 1. We begin with a Bridge problem from Jorgen Harmse:



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO: ALLAN GOTTLIEB
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715 BROADWAY, 10TH FLOOR
NEW YORK, N.Y. 10012
OR TO: GOTTLIEB@NYU.EDU

♠ A K 3 2
♥ 9 8 3
♦ A Q 10 T 6
♣ 4 3

♠ 9 8 7
♥ 10 7 x 2
♦ 4 3 2
♣ 7 6 2

You lead the deuce of hearts against 3NT, and your partner's ace brings down Declarer's king. Your partner leads the queen and Declarer discards. Explain the importance of your third heart (marked x).

OCT 2. Nob Yoshigahara has a color-based crypt-arithmetic problem. As usual, you are to substitute digits for letters to validate the following equations.
YELLOW + YELLOW + RED = ORANGE
RED x BLUE = YELLOW
RED x RED = WHITE

OCT 3. Winslow Hartford writes that his misspent youth at conventions infested with salesmen convinced him to write the following in a column about cancer clusters for the *Charlotte Observer*: "Dollar-bill poker": This is a friendly scam practiced at conventions. As there are eight numbers on the bill and 10 digits in all, you'd think multiple digits would be rare. But of 10 bills drawn from my wallet, nine showed "clusters" (two full-houses, four two-pair, three one-pair). (The "operator" of this scam, having changed a \$50 bill in advance, is almost sure to have five of a kind). This report suggests a question for Puzzle Corner: How many random \$1 bills does the operator need to:

- have a 50% chance of 5 of a kind?
- have a 90% chance of 5 of a kind?

Speed Department

George Blondin wishes to tell "Speedy Jim" [Landau] that there is an English word [kinda sorta] with SIX consecutive double letters. What is it?

Solutions

M/J 1. Jorgen Harmse, inspired by a previous Bridge column asking how well you could do

with a lousy hand, has a reverse question basically asking how bad can things get when you have a great hand. Specifically Harmse writes: You hold the AKQ of spades, hearts, and diamonds and the AKQJ of clubs (I told you it was a great hand!). What is the highest contract the opponents can make against best defense?

Joseph Keilin shows us that things can really go bad even when "you've got the goods."

In no trump the opponents make zero tricks regardless of who is on lead and how the hand is played. In a trump contract the defense must take at least three trump tricks, so the best the opponents can make is 10 tricks, which is possible with the following layout in spades. (Four hearts or diamonds can be made with analogous layouts.)

		North (Vul)	
		♠ X X X	
		♥ X X X X X	
		♦	
		♣ X X X X X	
West			East
♠ X X X X X	Contract: 4 spades by South		♠ A K Q
♥ X X X X			♥ A K Q
♣ X X X X			♦ A K Q
			♣ A K Q J
		South (Vul)	
		♠ X X X X X X X	
		♥	
		♦ X X X X X X	
		♣	

West's best lead is a club. South ruffs. South crossruffs diamonds and clubs three times ending in the South hand. At this point South and East each have three trumps. South keeps leading diamonds until East ruffs in. At this point South has three trumps and East only two. If East draws trump South can trump whatever East returns and make his remaining diamonds. If East returns a heart, South ruffs and continues diamonds, putting East in the same position as before. South ends up making three ruffs in the North hand and four ruffs and three diamonds in the South hand. If West had lead either a diamond or heart, the play is similar. South ends up in his own hand after ruffing three diamonds in the North hand and three hearts or clubs in the South hand. At this point he has four spades to East's three, although that hardly matters. He continues leading diamonds as before with the same result.

Although you asked for a maximum contract and not maximum score, the maximum score can be achieved with a contract of one spade (or heart) doubled and redoubled for a score of 770 plus game bonus in contract bridge and 1270 in duplicate.

M/J 2. Mark Oshin notes that, given a regular tetrahedron, there is a plane that is equidistant from the four vertices; in fact there are several such planes. How many?

The following solution is from Charles Wampler:

Continued on Page MIT 60

MIT LIFE INCOME FUNDS

MRS. CONCORDIA CHEN

HOME: Hong Kong and Hopewell Junction, New York

CAREER: While working as a systems engineer for Honeywell, Concordia Chen enrolled in a Ph.D. program in mathematics at MIT. In 1968, she joined IBM, where she was a manager of systems programming and architecture, a marketing consultant and a senior planner developing IBM's markets in South America, Europe and Asia.

In 1992, Concordia started a new career as program manager for the Chiang Industrial Charity Foundation in Hong Kong, which is devoted to elevating the living standard of the Chinese people through the development of machinery and manufacturing industries in China.

Concordia has been active with the Association of MIT Alumnae, has chaired the Educational Council, and was president of the MIT Club of Hudson Valley. In 1993, she was awarded the Harold E. Lobdell '17 Distinguished Service Award in recognition of her special efforts for MIT. Concordia's husband, Chin, is a professor of oceanography at Western Connecticut State University. They have three children, two of whom have MIT degrees.

MIT LIFE INCOME FUND: Concordia Chen Charitable Trust.

QUOTE: There is a Chinese phrase,

取諸社會，用諸社會， which means, "taken from the society and given back to the society." All of my good fortunes — my parents' love and teaching, my family, my education, my career, my friends — are given by society in a sense. Therefore, I want to return the favor. For me, the best way is through an MIT Life Income Fund trust, which pays income to me for my life, and then supports a scholarship fund I have named in memory of my parents.

For more information about MIT Life Income Funds, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, 77 Massachusetts Avenue, Room 4-234, Cambridge, MA 02139-4307; (617) 253-3827.

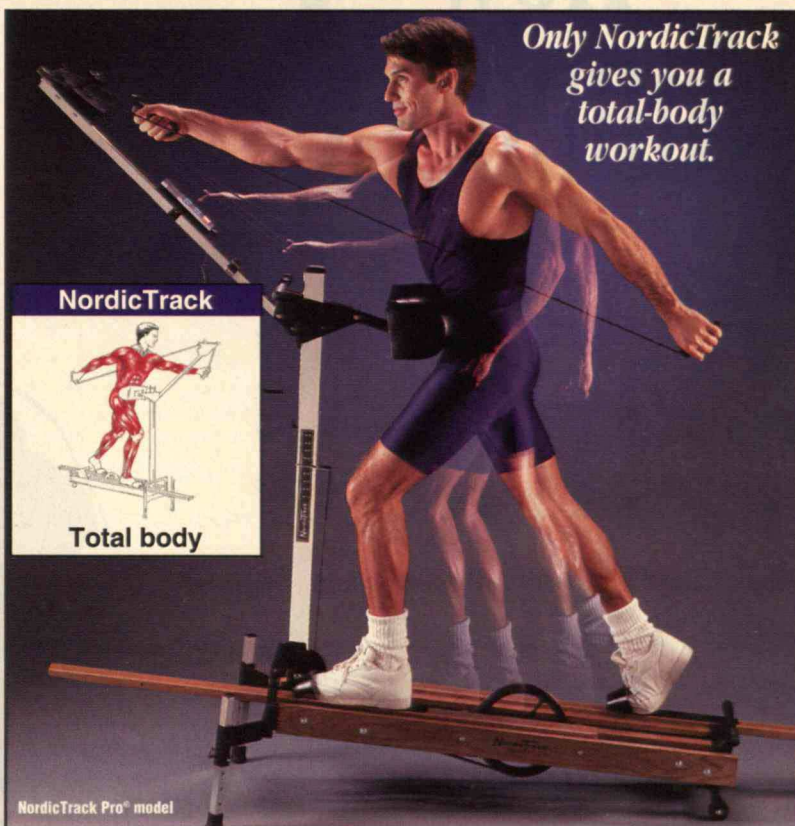
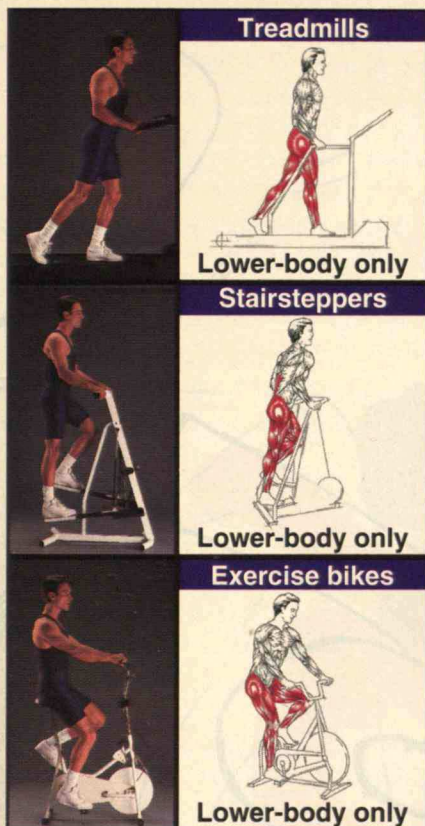
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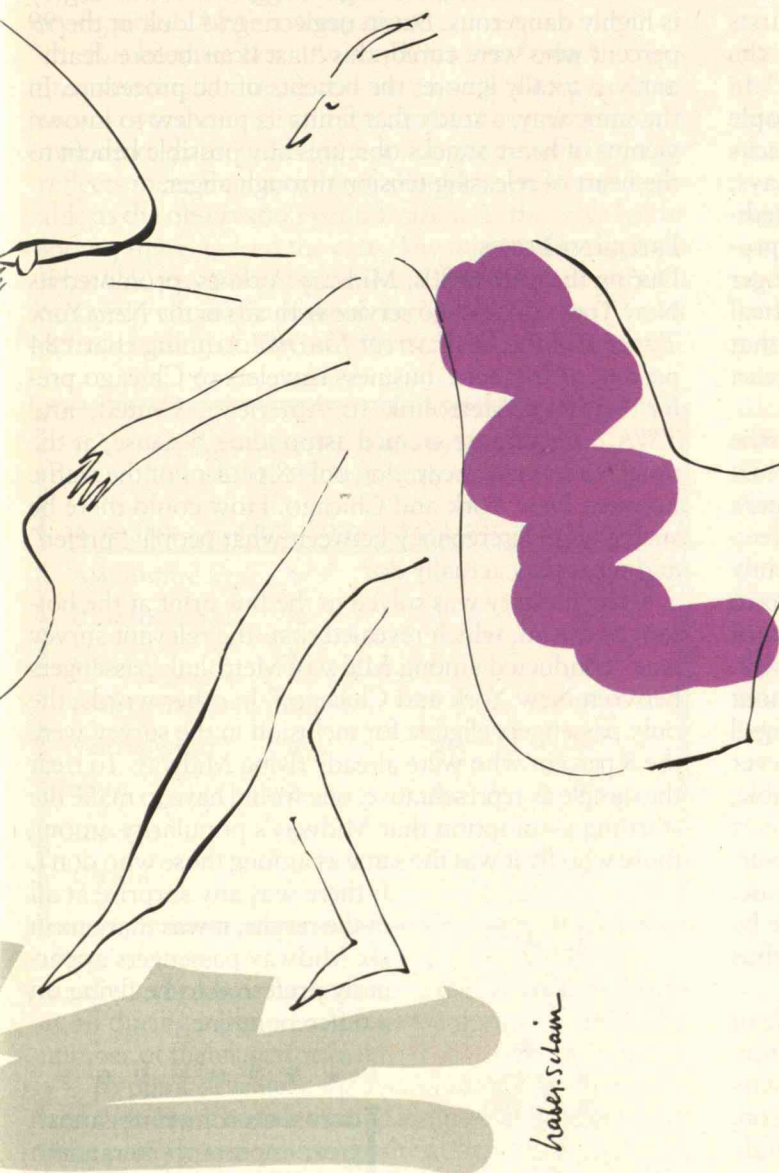
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How Numbers Can Trick You

*The statistics that
fill the media
are often subtly
misleading.
Here's a guide
to the most
common types
of error.*

BY ARNOLD BARNETT



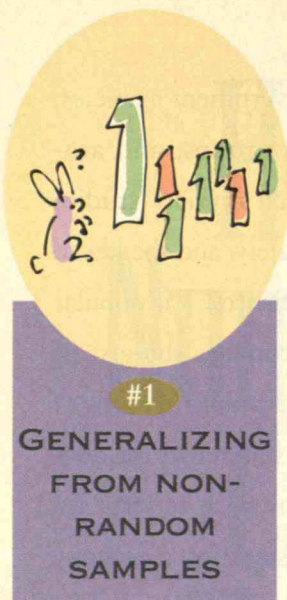


THINK tanks, government agencies, special-interest groups, and academics conduct myriad studies about health, safety, and the physical and social sciences. The popular press usually conveys the gist of these studies to the general public in terms of statistics that are meant to summarize the findings. Unfortunately, many such reports are compromised by errors in statistical reasoning. And while people have developed a healthy skepticism about advertisements that also appear in the media, the numbers in these

paid-for messages can be even more distorted than we cynically imagine.

A substantial fraction of statistical misunderstandings fall into a half-dozen categories—the Six Deadly Sins of Statistical Misrepresentation. I offer examples of these errors below; while they are drawn mostly from criminology and aviation (domains with which I am particularly familiar), they have plenty of counterparts elsewhere. My hope is to help audiences of the popular media—that is, just about everybody—to detect difficulties often apparent only to those with independent information about the subject, and to discourage fellow citizens from taking a strong position or course of action based solely on a press report.

ILLUSTRATIONS
BY TAMAR HABER-SCHAIM



Statistics about unusual sub-populations are often interpreted as applying to an entire population. Such extrapolation can yield misleading and even ludicrous results.

ANGRY HEARTS

In March 1994, an Associated Press story in the *Boston Globe* reported of a study that had concluded that outbursts of anger "can double the chance for heart attack." In interviews with 1,500 people who had suffered heart attacks in the previous few days, researchers at Harvard Medical School found that a dispro-

portionate number reported episodes of extreme anger in the two hours preceding the attack. A statistical analysis by the researchers led them to estimate that "anger was associated with 2.3 times the usual (heart attack) risk."

There's a problem here: the only contributors to the data analysis were people who had suffered heart attacks—and had survived them. Thus, the newspaper's implied advice to the broader population—"keep cool"—may have been misguided. Although the study indicated that vigorously "blowing off steam" seems to raise the *immediate* risk of heart attack, such releases of tension could serve to reduce the overall long-term risk. But people who had freely expressed anger throughout their lives—and who had, perhaps as a result, managed to live to old age without a heart attack—could never make it into the researchers' sample. It is also possible, though perhaps far-fetched, that those whose heart attacks were instigated by anger were better able to survive them than are other such victims. Were that the case, angry people could be overrepresented in the sample by virtue of their ability to survive a heart attack and thus become available for an interview.

To illuminate the difficulty, let's look at a couple of examples—one real, the other hypothetical. If you looked at the age at death of deceased rock-and-roll stars (Buddy Holly, Jimi Hendrix, Janis Joplin, Jim Morrison, Kurt Cobain, et al.), you might superficially conclude that rock stars die about 40 years younger than the general population. This interpretation is invalid, though, because the sample is biased, systematically excluding those icons of rock who are still alive; for all we know,

Mick Jagger might live to be 90. The same problem afflicts analyses of angry Americans—the analyses are restricted to those among them who *get* heart attacks.

More hypothetically, suppose that disease X, if untreated, is fatal 20 percent of the time. Now imagine that there is a widely used surgical procedure for this disease that kills 1 percent of the patients who undergo it but that cures the other 99 percent. Of those people whose deaths are attributable to disease X, an awful lot will have spent their final hours on the operating table. Viewed in isolation, this might suggest that the surgery is highly dangerous. But in neglecting to look at the 99 percent who were cured, this "last hour before death" analysis totally ignores the benefits of the procedure. In the same way, a study that limits its purview to known victims of heart attacks obscures any possible benefit to the heart of releasing tension through anger.

FREQUENT FLIERS

During the mid-1980s, Midway Airlines promoted its New York-to-Chicago service with ads in the *New York Times* and the *Wall Street Journal* claiming that "84 percent of frequent business travelers to Chicago prefer Midway Metrolink to American, United, and TWA." This figure seemed astounding because, at the time, Midway was carrying only 8 percent of the traffic between New York and Chicago. How could there be such a huge discrepancy between what people "prefer" and what they actually do?

The mystery was solved in the fine print at the bottom of the ad, which revealed that the relevant survey was "conducted among Midway Metrolink passengers between New York and Chicago." In other words, the only passengers eligible for inclusion in the survey were the 8 percent who were already flying Midway. To treat the sample as representative, one would have to make the startling assumption that Midway's popularity among those who fly it was the same as among those who don't.

If there was any surprise at all in the results, it was that one in six Midway passengers apparently preferred to be flying on a different airline.



ARNOLD BARNETT is professor of operations research at MIT's Sloan School of Management, where he specializes in applied probability and statistics. Both *Business Week* and *Fortune* have cited Barnett as one of the most effective business-school teachers in the United States.

Journalists sometimes attach great importance to random data shifts that may already be irrelevant by the time they are reported. Admittedly, it's not always easy to distinguish a mere fluctuation from the start of a meaningful trend. The effort to do so is worth making, however, and in some cases pays off quickly.

AIRLINE SAFETY

In 1993, the International Airline Passengers Association (IAPA) began rating airlines in terms of safety. IAPA focused on the decade ending in 1993 and rated airlines primarily on the basis of two ratios: fatal accidents per million flights performed, and passengers killed per million passengers carried. Among large U.S. jet carriers, American, Delta, and Southwest were classified as "outstanding," while Continental, Northwest, TWA, United, and USAir received the positive but clearly lesser designation "very good." Newspapers around the country reported IAPA's investigation.

But because fatal air accidents involving U.S. jets are exceedingly rare, even airlines with the same safety record over the long run can differ in safety performance over short spans. Indeed, if a ranking of carriers by safety reflects mere fluctuations, it should be highly changeable as the observation period varies. As the table below shows, this is indeed the case. The table ranks the eight large U.S. jet carriers by the death risk for a person who randomly chose one of the airline's flights during 10-year periods ending in 1983, 1988, and 1993. The lower the

AIRLINE	12/31/93	12/31/88	12/31/83
AMERICAN	1*	6	7
CONTINENTAL	4	4	5
DELTA	5	5	1*
NORTHWEST	7	7	2*
SOUTHWEST	2*	2*	4*
TWA	3	3	8
UNITED	6	1*	6
USAIR	8	8	3*

numbers, the fewer the fatalities. (Airlines with no deaths at all during a period are starred; these are ranked by number of flights performed.)

To put it delicately, the results cannot be characterized as stable. The first-ranked airline was different in all three periods and, strikingly, the airline that was best in one period always fell in the bottom half of the rankings in the other two. Southwest Airlines had a perfect record over all three periods but, because it had far fewer flights than the other carriers, was in a better position than they to avoid fatalities. The two airlines that were ranked lowest in the two most recent periods (Northwest and USAir) had no passenger deaths at all in the third. The mortality data, in short, provide a pitifully tenuous basis for putting these airlines

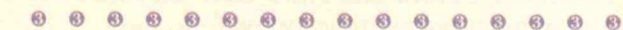
into two distinct categories—a point that was overlooked both by IAPA's analysts and by the newspapers that publicized their results.

FOREIGNERS IN FLORIDA

Last October, after a well-publicized murder of a German tourist in Florida, the whole world heard that in fact nine foreign tourists had been slain in that state during the preceding year. Fear of such violence has cost Florida hundreds of thousands of recent visitors, yet this response could well be an overreaction to statistical noise.

Even if homicides against foreign tourists in Florida occur at a low, constant rate over time, there are bound to be some periods when the rare events bunch together, much as there will be other periods when none occur at all. Suppose, for example, that over many years there is on average a 1 percent chance each day that a foreign tourist will be murdered somewhere in Florida. Such killings will average 3.65 per year ($365 \times .01$), and the average interval between successive killings will be 100 days—long enough, presumably, to dispel inclinations to speak of a trend. But probabilistic calculations (not included here) also show that, over a full decade, the chance is nearly 3 in 10 that there will be *some* 12-month period with 9 or more killings; over a 20-year period, the chance of such a bloody stretch rises to roughly 1 in 2.

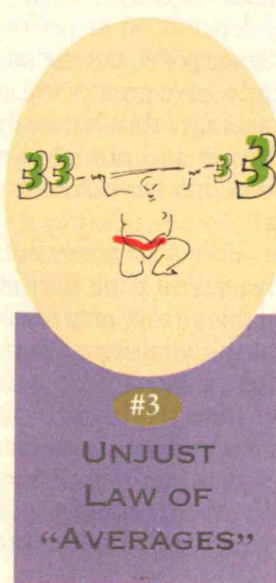
In the six months following October 1993, the press fell silent on the subject of murders of foreigners in Florida. Conceivably, a menacing trend was reversed because of sensible measures it provoked, such as the elimination of visible evidence that a car is rented. But it is also quite possible that there was no real trend to reverse, and that the pattern no more signaled heightened danger to foreign tourists than a year without murders would have signaled a future free of risk.



Summary statistics about two large sets of data can invite conclusions that would not stand if the sets were examined individually, in greater detail. Comparisons of overall averages can yield particularly distorted impressions.

UNDERPAID DOCTORS?

U.S. News and World Report told us in 1983 that U.S. physicians were "growing in number but not in pay." Its chart showed that between 1970 and 1982, the number of doctors jumped



But some arithmetic raises doubts that the market's "invisible hand" was responsible for this sag. It seems reasonable to assume that perhaps 25 percent of the doctors practicing in 1970 (some 83,500) had retired by 1982, leaving about 250,000 at work. This means that roughly half the 480,000 doctors working in 1982 had begun practicing during the last 12 years. Because of this large influx, the typical physician in 1982 was probably younger than his or her 1970 counterpart. And since salaries tend to increase with age, the decline the magazine saw might well have reflected a downward shift in the age distribution among doctors rather than reduced compensation at any given age.

"ON-TIME" AIRLINES

Each airline's on-time score depends on its performance ratings at the 30 individual airports, but the airports the airliners serve frequently have greater effect than those it serves rarely. The averages thus naturally favor an airline that mostly flies in and out of fair-weather airports over those airlines that serve cities frequently socked in by rain or fog.

For example, America West Airlines routinely outperforms Alaska Airlines in overall on-time performance, but on further inspection this victory seems hollow. Alaska serves only five of the thirty busiest airports and, as we can see from the following table, it was prompter than America West in June 1991 at all five. But if one computes the *average* performance for flights into those five airports, America West receives a better rating. This counterintuitive result arises because a large majority (73 percent) of America West's flights into

these five airports arrive at desert-sun Phoenix. Thus, America West's 92.1 percent on-time record at Phoenix dominates its five-airport statistic. Alaska Airlines scored even better in Phoenix than America West did (94.8 percent on time), but because only 6 percent of Alaska Airlines's flights go into or out of Phoenix, this result has little effect on its five-city average. By contrast, 57 percent of Alaska's flights arrive at Seattle—one of the moody weather capitals of the world—as opposed to only 4 percent of America West's. In the five-city average, in other words, America West gets to put its best foot forward and bury one of its weakest scores; Alaska Airlines is forced into the opposite position.

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Fundamental misunderstandings of statistical results can arise when two words or phrases are unwisely viewed as synonyms, or when an analyst applies a particular term inconsistently.

THE ODDS OF EXECUTION

A powerful example of the first problem arose in 1987, when the U.S. Supreme Court issued its controversial *McCleskey v. Kemp* ruling concerning racial discrimination in the imposition of the death penalty. The Court was presented with an extensive study

of Georgia death sentencing, the main finding of which was explained by the *New York Times* as follows: "Other things being as equal as statisticians can make them, someone who killed a white person in Georgia was four times as likely to receive a death sentence as someone who killed a black."

The Supreme Court understood the study the same way. Its majority opinion noted that "even after taking account of 39 nonracial variables, defendants charged with killing white victims were 4.3 times as likely to receive a death sentence as defendants charged with killing blacks."

But the Supreme Court, the *New York Times*, and countless other newspapers and commentators were laboring under a major misconception. In fact, the statistical study in *McClesky v. Kemp* never reached the "factor of four" conclusion so widely attributed to it. What the analyst did conclude was that the odds of a death sentence in a white-victim case were 4.3 times the odds in a black-victim case. The difference between "likelihood" and "odds" (defined as the likelihood that an event will happen divided by the likelihood that it will not) might seem like a semantic quibble, but it is of major importance in understanding the results.

The likelihood, or probability, of drawing a diamond from a deck of cards, for instance, is 1 in 4, or 0.25. The odds are, by definition, 0.25/0.75, or 0.33. Now consider the likelihood of drawing any red card (heart or diamond) from the deck. This probability is 0.5, which corresponds to an odds ratio of 0.5/0.5, or 1.0. In other words, a doubling of probability from 0.25 to 0.5 results in a tripling of the odds.

The death penalty analysis suffered from a similar, but much more serious, distortion. Consider an extremely aggravated homicide, such as the torture and killing of a kidnapped stranger by a prison escapee. Represent as PW the probability that a guilty defendant would be sentenced to death if the victim were white, and as PB the probability that the defendant would receive the death sentence if the victim were black. Under the "4.3 times as likely" interpretation of the study, the two values would be related by the equation:

$$PW = 4.3 PB$$

If, in this extreme killing, the probability of a death sentence is very high, such that $PW = 0.99$ (that is, 99 percent), then it would follow that $PB = 0.99/4.3 = 0.23$. In other words, even the hideous murder of a black would be unlikely to evoke a death sentence. Such a disparity would rightly be considered extremely troubling.

But under the "4.3 times the odds" rule that reflects the study's actual findings, the discrepancy between PW and PB would be far less alarming. This yields the equation:

$$\frac{PW}{1 - PW} = 4.3 \left[\frac{PB}{1 - PB} \right]$$

If $PW = 0.99$, the odds ratio in a white-victim case is 0.99/0.01; in other words, a death sentence is 99 times as likely as the alternative. But even after being cut by a factor of 4.3, the odds ratio in the case of a black victim would take the revised value of $99/4.3 = 23$, meaning that the perpetrator would be 23 times as likely as not to be sentenced to death. That is:

$$\frac{PB}{1 - PB} = 23$$

Work out the algebra and you find that $PB = 0.96$. In other words, while a death sentence is almost inevitable when the murder victim is white, it is also so when the victim is black—a result that few readers of the "four times as likely" statistic would infer. While not all Georgia killings are so aggravated that $PW = 0.99$, the quoted study found that the heavy majority of capital verdicts came up in circumstances when PW , and thus PB , is very high.

None of this is to deny that there is some evidence of race-of-victim disparity in sentencing. The point is that the improper interchange of two apparently similar words greatly exaggerated the general understanding of the degree of disparity. Blame for the confusion should presumably be shared by the judges and the journalists who made the mistake and the researchers who did too little to prevent it.

(Despite its uncritical acceptance of an overstated racial disparity, the Supreme Court's *McClesky v. Kemp* decision upheld Georgia's death penalty. The court concluded that a defendant must show race prejudice in his or her own case to have the death sentence countermanded as discriminatory.)

THE SKYLAB IS FALLING! THE SKYLAB IS FALLING!

In 1979, the National Aeronautics and Space Administration (NASA) decided to warn people that the Skylab space station had dropped out of orbit and was headed toward the earth, where its debris could scatter on a populated area. To make its announcement less frightening, NASA administrator Robert A. Frosch offered an accompanying risk assessment widely repeated in the press:

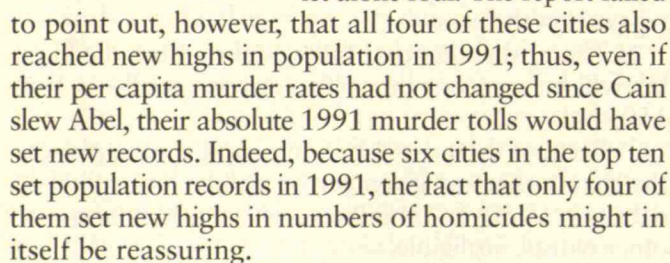
1) The probability that falling debris from the Skylab will hit someone on earth—anyone at all—is 1 in 150; and

2) Because there are 4 billion people on the planet, the chance that any given person will be hit by Skylab debris is $(1/150) \times (1/4 \text{ billion})$, or 1 in 600 billion—in other words, negligible.

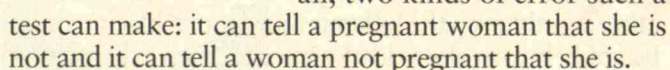
Fortunately, the debris fell harmlessly in a remote part of Australia. But the lesson is that an elusive word like "someone" is not useful in describing an event. When a word can be construed in different ways, the reader and even the data analyst can unintentionally jump from one interpretation to another, as presumably NASA did when it first equated "someone" to "at least one" but then shifted to "exactly one" in the middle of its calculation.

In 1982, *National Review* magazine announced that it had "good news for all egalitarians and redistributionists." Apparently, the Internal Revenue Service had found even more effective ways to soak the rich. The principal piece of evidence for this conclusion was that in 1980, the top 10 percent of U.S. earners paid 52 percent of all federal income tax, up from 49 percent five years earlier. The article encouraged the reader to assume that had not the IRS tinkered with its tax codes, the share of taxes the wealthiest 10 percent paid in 1980 would have remained at its 1975 level.

But the magazine advanced this point with incomplete evidence. In fact, it was perfectly conceivable that the top 10 percent was paying a growing share of the nation's taxes simply because this group's share of the nation's income was going up. In this particular case, the faulty assumption was not fatal because the unchecked data about earnings among the wealthy supported the story's claim: the share of income amassed by the wealthiest 10 percent of Americans changed very little from 1975 to 1980. But the glib comparison between the two years was unsound, and invoking the same "top tenth" argument for the 1980s—when the Census Bureau reports that U.S. income inequality did indeed rise sharply—would produce a quite misleading result.



Early in 1992, the *New York Times* reported that record numbers of killings occurred the previous year in four of the nation's ten largest cities: Los Angeles, San Diego, Dallas, and Phoenix. The implication was that even one all-time high among such cities was unusual, let alone four. The report failed



An advertisement for a home pregnancy test boasted that, under laboratory conditions, the test was 99.5 percent accurate. There is no reason to disbelieve that statistic, although a single error rate seems unnecessarily vague. There are, after all, two kinds of error such a

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	ACTUALLY PREGNANT	ACTUALLY NOT PREGNANT
TEST SAYS PREGNANT	197	0
TEST SAYS NOT PREGNANT	1	2
TOTAL	198	2

two questions. Why were 99 percent of the women tested—198 out of 200—pregnant? And, even more strangely, why was the accuracy of the test for nonpregnant women estimated from a sample size of *two*?

Things got worse as the brochure went on. The 2-for-2 accuracy statistic about nonpregnant women was based on an analysis of the test results by laboratory technicians. But the main advantage of a home pregnancy test is that women can use it themselves. The brochure took account of this issue by reporting what happened when the women interpreted results on their own: of 101 such women who were not pregnant, 8 mistakenly concluded that they were.

In other words, the manufacturer had two accuracy results about nonpregnant women. One, based on a (presumably) representative sample of the product's users, showed an error rate of 8 percent in 101 trials. The other, based on a "sample" of laboratory technicians, obtained a 0 percent error rate over 2 trials. In its advertising, the manufacturer applied the 0 percent rate in the small expert sample and ignored the 8 percent rate in the large, unbiased one.

SAFE TRAVELING

It is widely known that auto-safety statistics are grim while air safety data are greatly reassuring. Yet many people feel safer driving than flying, largely because they think themselves such good drivers that the fatality rates don't really apply to them. Such flattering self-assessments received apparent support from a 1991 study described in the journal *Risk Analysis*. The study's primary finding (which was reported in both the *Wall Street Journal* and the *Washington Post*) was that a prototypical safe U.S. driver—age 40, sober, belted into the seat of a heavier-than-average car—actually suffers "slightly less" mortality risk on a 600-mile trip than a person who takes the same trip by air.

The analysis began with the overall death rate per mile driven on rural interstate highways, the main thoroughfares for intercity auto trips. The researchers then

revised this initial risk estimate using multipliers that reflected various characteristics of cars and drivers. Having a heavier-than-average car multiplied the risk estimate by 0.77 (that is, reduced it by 23 percent), while having a 40-year-old driver multiplied the estimate by 0.68. The final risk factor for a particular combination of factors was the product of the individual adjustments.

Unfortunately for those who prefer to drive, this analysis greatly exaggerates the safety of driving because the risk-reduction factors are not truly independent: Part of the *reason* 40-year-olds die less frequently in car crashes than 18-year-olds is that the middle-aged motorists tend to drive heavier cars, wear seat belts, and stay off the road when intoxicated. Taking credit for each of these factors separately, as the study did, amounts to quadruple-counting and greatly overstates the safety of driving versus flying.

The study exacerbated this error by failing to distinguish between the safety records of different types of aircraft. In their risk calculations for 600-mile flights, the researchers worked with merged accident data for all types of aircraft. But a flight of 600 miles is almost always performed by a jet, and jets have far better safety records than propeller planes. The peculiar approximations of this study led it to conclude that the mortality risk from driving 600 miles was comparable to that of flying 600 miles. A more fair and logical analysis would show that flying is safer by a factor of at least five.

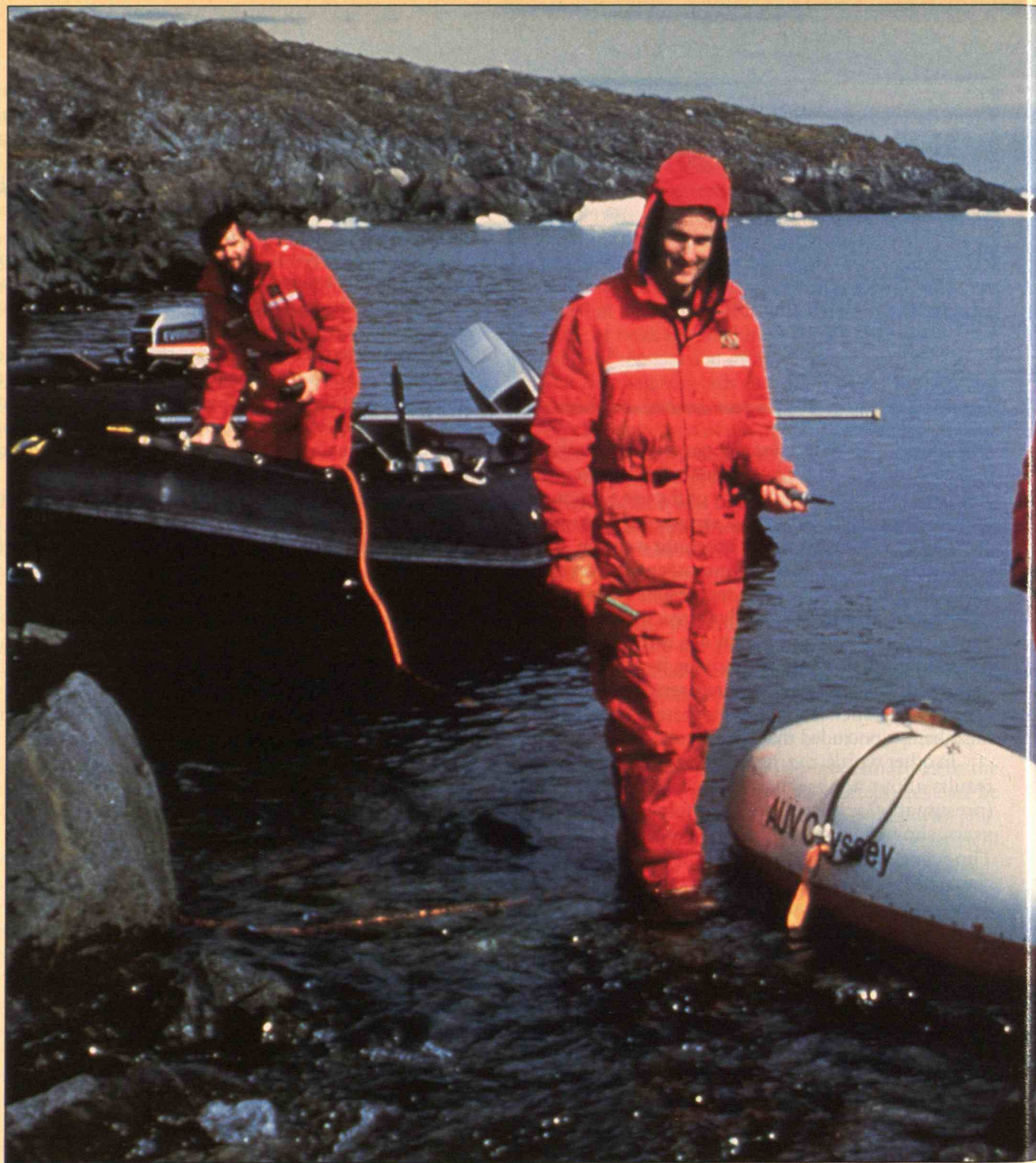
Toward Statistical Literacy

When Miss Marple, Agatha Christie's famous detective, was asked why she always believed the worst about human nature, she responded that "the worst is so often true." Similarly, statistical reports in the media involve flaws regularly enough that some initial skepticism is well deserved.

The most cautious general course for the reader is to treat such reports more as public announcements that studies have been done than as clear guides to their content or reliability. Readers might not only look for evidence that researchers, reporters, or advertisers have committed one or more of the six deadly sins but also cultivate a general awareness that statistics can yield highly divergent interpretations. When a particular interpretation of the reported data pattern is advanced, have the analysts reasonably excluded other possibilities, or failed even to recognize them?

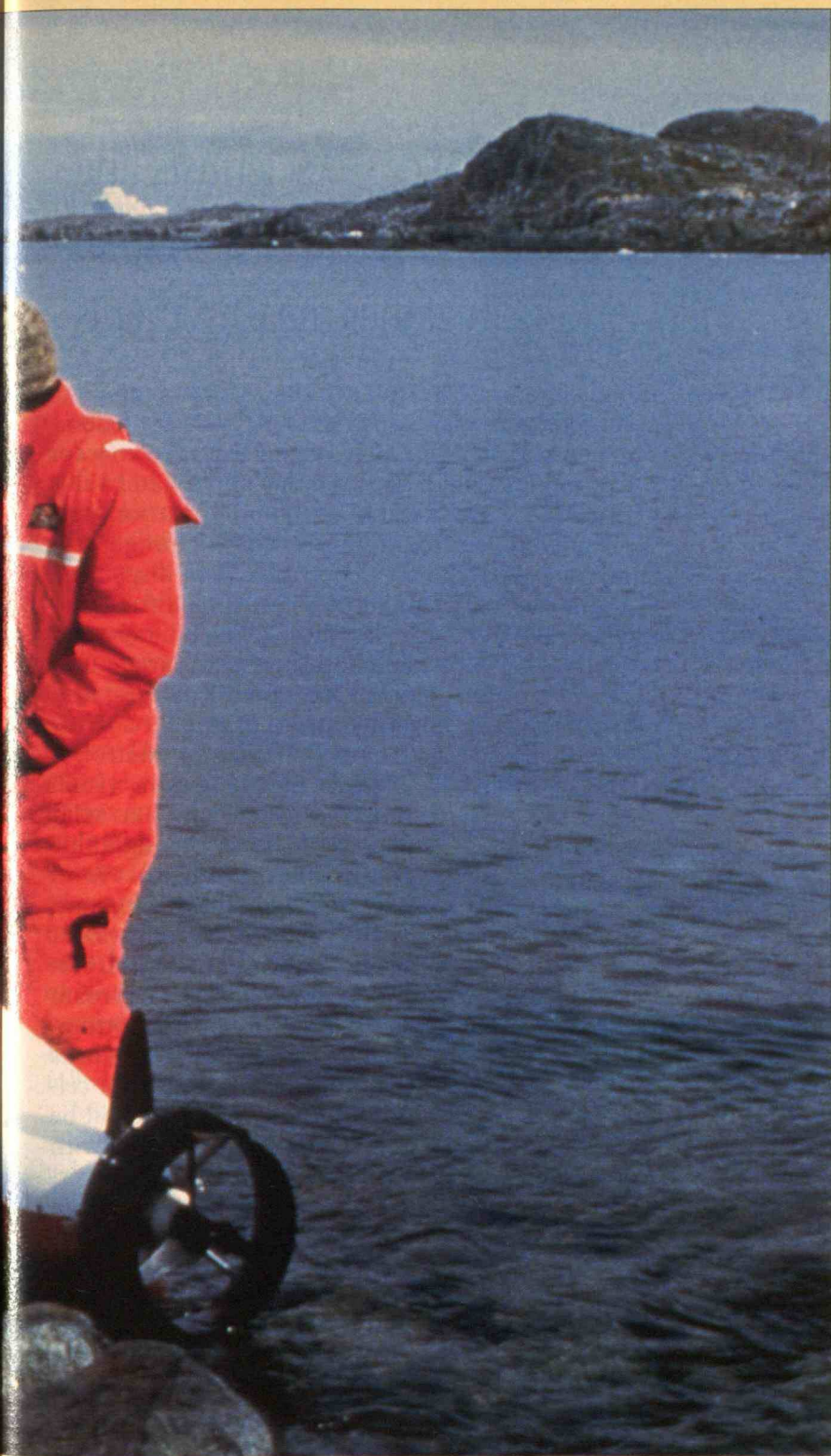
Ultimately, should the conclusions really matter to the reader, then there is no avoiding the arduous task of finding the study and reading it. And contacting the author for further details is both wise and legitimate.

For the alert individual, statistical humbug should be no harder to ferret out than other forms of illogical argument. It just takes practice and time. ■



*James Bellingham (left)
and colleagues from
MIT's Sea Grant Program
prepare Odyssey for a
mission in the Antarctic.*

Down to



LINKED TOGETHER BY

UNDERWATER COMMUNI-

CATION NETWORKS, AN

ARMADA OF TINY

AUTONOMOUS VEHICLES

COULD STUDY THE

OCEANS AS NEVER

BEFORE, AS WELL AS

ASSIST IN MINERALS

EXTRACTION, PROTECT

THE ENVIRONMENT, AND

RIDE HERD ON FISH.

the Sea in Robots

BY J. ROBERT FRICKE

A

s this is written, I am quite literally at sea. We—50 scientists and crew—are plodding along on a research vessel at a sluggish 3 knots, 1,000 kilometers from land, working to gather measurements

from a tiny patch of the ocean. In the last year I've spent more than two months at sea collecting several trillion bytes of sonar data. Scores of other researchers have made similar efforts. But even with many research ships operating year-round, the information we gather provides only a glimpse of the ocean's physical, chemical, and biological processes. Because phenomena such as turbulence, the transport of sediments and chemicals, and the migration of plankton are highly dynamic, fully understanding them would require continuous, simultaneous measurements spanning weeks or years and thousands of kilometers. Instead, we have only spot measurements, sparsely distributed around the globe. The result is that we know less about the deep ocean than we know about Venus, Mars, and the dark side of the moon.

Given the vastness of the problem, more ships and more scientists are not the answer. In fact, no existing technology can provide the depth and breadth of coverage necessary to understand oceanic processes. Although submersibles with human crews expand the depths at which measurements can be taken, they are costly to operate and they put lives at risk. So-called remotely operated vehicles—such as *Jason*, the vehicle that explored the *Titanic*—can venture to depths where humans cannot dive, but they require a tether for power and communications; tethers severely restrict a vehicle's maneuverability, and the system for managing them is often as complicated as the vehicle itself.

Fortunately, the gradual convergence of several new technologies

J. ROBERT FRICKE, an assistant professor in MIT's Department of Ocean Engineering, first worked with autonomous underwater vehicles in the early 1980s for seismic exploration of oil and gas. More recently he has been developing sonar imaging and environmental geophysics sensors for AUVs.

promises to bring us closer to the goal of obtaining a comprehensive view of the seas. A loose confederation of research engineers is moving toward a concept that combines small autonomous underwater vehicles (AUVs), underwater telecommunication networks, and oceanographic sensors. Though still embryonic, AUVs offer the possibility of dispensing with the main drawbacks of ships, submarines, and remotely operated vehicles: they can be built cheaply enough to be deployed continuously in large numbers; they do not subject humans to danger; and because they maneuver by means of onboard artificial intelligence, they require no tether for control.

Under the long-term vision now being developed at MIT, Woods Hole Oceanographic Institution, the Office of Naval Research, and other institutions, AUVs packed with lightweight sensors—acoustical, optical, biological, and chemical—will roam the seas from top to bottom. Communicating over networks that resemble those used for cellular phones, the AUVs will be able not only to share data with each other but also to pass messages to surface buoys that will relay them by satellite to scientists on land. Similarly, scientists will be able to communicate with the AUVs, sending them information and instructions.

The benefits of these new vehicles and communication systems will extend well beyond the field of ocean science. The same technology could prove to be of enormous commercial and environmental value, improving the safety and efficiency of underwater oil production, enabling new approaches to managing fisheries, enhancing pollution monitoring, and assisting in marine operations such as salvage.



Towed platforms (such as the sonar unit at top being readied for launch from the Maurice Ewing, the Lamont-Dogbert Earth Observatory's research vessel) and remotely operated vehicles (such as Jason, shown at bottom exploring the wreckage of the Titanic) require cumbersome and restrictive tethers. Autonomous underwater vehicles (AUVs) do not.

The Outlook for Robot Subs

Although significant progress in developing AUVs has occurred only in the last few years, the vehicles have a history dating to the last century. Torpedoes, a specialized form of autonomous vehicle, were moderately successful in destroying enemy ships during the U.S. Civil War, and were greatly refined in both world wars. The microelectronics revolution of the 1960s allowed the development of a more intelligent form of AUV. While most of these were preprogrammed and had only rudimentary fail-safe procedures to permit recovery during emergencies, there were notable successes. The French *Epaulard*, for example, could operate at 6,000 meters and hop along the seafloor snapping a photo with each bounce. And in the mid-1970s the Marine Systems Engineering Laboratory, formerly of the University of New Hampshire and now of Northeastern University, developed a vehicle known as *EAVE-East*, which could autonomously follow a pipeline.

More recently, a number of AUVs have been developed as vehicle concept test beds and as platforms for sensors. Two of these are of modest size, around 2 meters long: *Ocean Voyager II*, being developed at Florida Atlantic University, and *Phoenix*, a project under way at the Naval Postgraduate School in Monterey, Calif. Others belong to a class of small, special-purpose platforms known as micro-AUVs. *Seashuttle*, built by the University of Washington's Applied Physics Laboratory, is routinely used to survey ocean conductivity, temperature, and depth. And *EMATT* (*Expendable Mobile Anti-submarine-warfare Training Target*), a small acoustic platform developed by Sippican in Marion, Mass., is used to simulate enemy subs in Navy training missions.

Most vehicles built so far are expensive, sometimes costing millions of dollars, and all consume more power

than their developers would like them to. But size, cost, and power consumption have been coming down, and can be expected to continue dropping as microelectronic processing components shrink and become integrated with low-power micromechanical sensors.

Odyssey, a vehicle developed at the MIT Sea Grant Laboratory, represents the state of the art: it is small, inexpensive (around \$50,000), and capable. *Odyssey* is 2.2 meters long and weighs 195 kilograms; it can dive to 6,000 meters—making accessible all but a small fraction of the world's oceans—and can travel up to 1,000 kilometers at 3 knots, depending on the type of battery and the power needed by its sensors. Equipped with video and a range of sensors for taking oceanographic measurements, the vehicle has successfully completed missions in the waters off the states of Massachusetts and Washington and in both the Arctic and the Antarctic, from ship- and shore-based facilities.

Just as AUVs are improving in size and cost, they are also getting smarter. Yet the use of artificial intelligence to control underwater vehicles is, like most other AI applications, still in its infancy. There are many possible approaches and no clear rules.

Suppose a vehicle is sent to map a patch of seafloor. In transit to the site, it is programmed—for safety's sake—to navigate no closer than, say, 20 meters to the seafloor and no closer than 10

meters to the sea surface. But if the depth of the water unexpectedly decreases to less than 30 meters, what is the vehicle to do? Abandon the mission? Adjust its speed and safety margins? Split the difference? It all depends on how the controller has been programmed.

James Bellingham, the MIT research engineer who led the development of *Odyssey*, has pioneered a modular approach to vehicle control, in which different sets of instructions and priorities kick in as different situations



Today's AUVs come in a variety of shapes, sizes, and capabilities. The Naval Postgraduate School's Phoenix (top), shown gliding past the window of its test tank, is a 385-pound platform for developing advanced robotic control. "Micro-AUVs" include the University of Washington's Seashuttle (center), which contains oceanographic instruments yet weighs so little that developer Russell D. Light can carry it, and Sippican's EMATT, an expendable decoy used in training for anti-submarine warfare.

MIT Sea Grant's *Odyssey*, which can dive to 6,000 meters and travel 1,000 kilometers without recharging, represents the state of the art in AUVs.

Near right and center: The craft's latest incarnation, *Odyssey II*, undergoes tests at New Hampshire's Lake Winnepesaukee before embarking on an Arctic mission to study the mechanics of sea ice. Far right: A member of the *Odyssey II* team sets up an acoustic beacon to enable the vehicle to navigate beneath the Arctic ice.



arise. In the hypothetical scenario above, the module in charge of avoiding boundaries (a "safety" module) would switch to a strategy that might permit the vehicle to split the difference in the water column at a speed reduced in proportion to the water's total depth. The safety module might remain in control until the water depth reached, say, 15 meters, at which point it would relinquish control to a "survival" module, and so on. Each time *Odyssey* encounters a new situation, the craft's handlers can outfit the control software with a new module for dealing with that particular contingency in the future. Because the control modules are based on broad principles—such as "obstacle avoidance," which should prevent unpleasant encounters with any object, be it a sunken ship, a reef, or an oil rig—the number of modules the vehicle might ultimately need is expected to be manageable.

Once AUVs start being deployed in groups, they might use a type of control architecture known as distributed intelligence, sharing information so that the ensemble collectively coordinates the sampling strategy. If a strong current moved one vehicle off its intended track, it would call to other vehicles to fill in the gap. Although this form of artificial intelligence remains largely hypothetical, computer simulations have shown that autonomous entities such as AUVs can, at least in theory, be yoked together in this fashion.

Aside from the challenges of devising control software, two other tricky technical areas are power and navigation. The 1,000-kilometer range *Odyssey* achieves with high-efficiency lithium batteries is adequate for many uses but not ideal for transoceanic missions. Yet this problem does not seem to be intractable. Two consumer markets—laptop computers and electric cars—will demand significant

improvements in battery performance over the next decade, and as volume grows, the cost of this technology should shrink. Work on fuel cells as an alternative to batteries also looks promising.

Navigation, on the other hand, poses major hurdles. *Odyssey*, for example, combines two different techniques—dead reckoning and acoustic navigation—neither of which would be feasible for AUVs in routine use. Because of varying currents, dead reckoning—where calculations are based solely on direction and speed—can produce errors on the order of 10 percent of the distance traveled. Acoustic navigation, in which a craft triangulates its position by listening to signals from a series of underwater "pingers," is generally more accurate, but it works poorly in shallow water, where sound waves reverberate off the bottom and the surface. One hope is that Navy research on ways to compensate for this effect will be applicable to AUVs. But even then, acoustic navigation would still require external sound generators and hence may be impractical for global use.

An alternative would be to use inertial navigation, in which gyroscopes determine the heading and accelerometers sense variations in velocity. But gyroscopes are power-hungry, and their accuracy depends on their size; inertial navigation would probably be as error-prone as dead reckoning when used on craft as small as AUVs. Although more accurate inertial navigation packages are being evaluated for use on *Odyssey*, no dramatic breakthroughs are expected in this area.

That leaves terrain-based navigation, a technique used by aircraft such as the Tomahawk cruise missile. In the airborne version of terrain-based navigation, a vehicle keeps track of its location by comparing radar images of the terrain below with electronic maps stored in computer memory. An underwater version would substi-



tute sonar imaging for radar. But the challenge for AUVs is twofold: no detailed database of the ocean seafloor is available, and vast expanses of the seafloor are essentially featureless. Despite these difficulties, terrain-based navigation has the potential to be accurate enough, and unlike acoustic navigation, it does not depend on external systems.

Researchers at MIT and Woods Hole Oceanographic Institution are vigorously pursuing ways of overcoming the difficulty of mapping the seafloor—for example, by supplementing images of undistinctive terrain with data on local magnetic fields and variations in gravity, both of which can serve as geographic markers, at least on a coarse scale. AUVs could even build maps themselves, making new terrain identifiable to the next vehicle that passes that way.

Deep Conversations

Once these technical barriers have been surmounted, squadrons of AUVs will need a way to communicate with one another and with people on shore. But because electromagnetic radiation does not propagate in water the way it does in air, radio communication is not available under the sea. The only long-range communication techniques that have proved successful in the ocean are based on sound.

Early acoustic underwater communication systems transmitted and received analog information, usually voice, with relatively low fidelity. Such systems, developed in World War II to allow submarines to communicate, worked by modulating the pressure of sound waves. In modern acoustic communication systems, data are sent digitally; the digital ones and zeroes may be represented either by

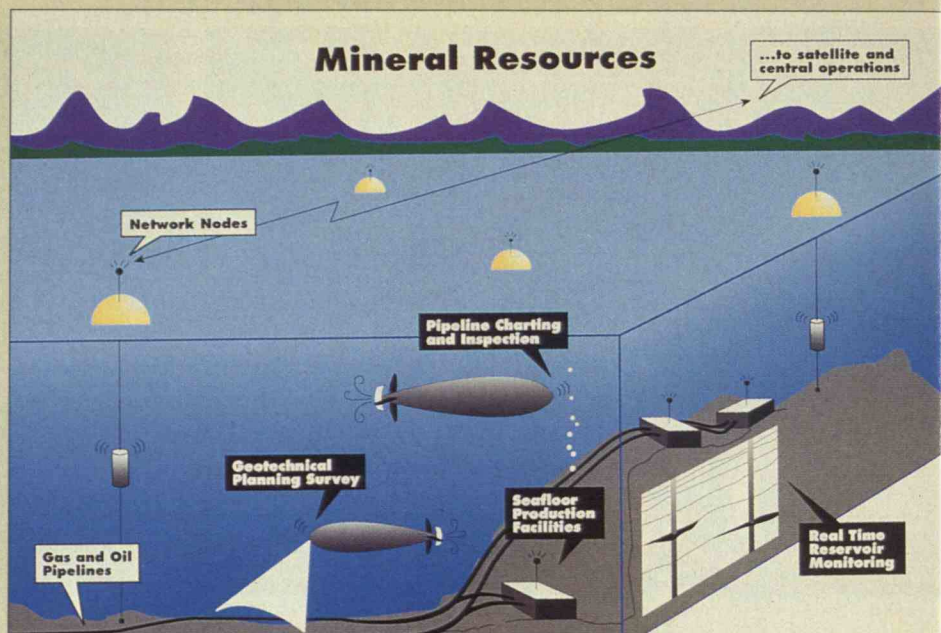
two different pitches or by two different phases of the same tone (that is, with sound waves initially at their maximum or minimum compression).

The challenge in underwater telecommunication is that the properties of the acoustic channel are constantly changing. Surface waves, variations in temperature, and tides and currents all affect the speed and direction of sound signals. Only by compensating for this variability is it possible to send data quickly and reliably. Researchers led by Josko Catipovic at Woods Hole Oceanographic Institution have devised ways to estimate the characteristics of the water channel through which a signal must travel and adjust the signal accordingly. This research has produced acoustic modems that transmit faster than 1,200 baud—a rate adequate for sending oceanographic data—and modems fast enough to transmit video images are in the works.

The Woods Hole team has configured the new modems into acoustic local-area networks, or ALANs, which route messages in much the same way as a cellular telephone network. Like a cellular phone call, a message sent from one node is routed from node to node until it reaches its destination. If certain underwater paths are too variable to use, the network automatically reroutes the message over the remaining paths.

Not only are ALANs faster and more reliable than the old analog systems, but because they relay data in a sequence of short hops, they can operate over a much longer range—around the world instead of a few miles. In several places around the world, ALANs have been hooked up to terrestrial radio links, which connect underwater instruments to shore-based scientific workstations, sometimes thousands of miles away. In a setup sponsored by the National Science Foundation, for example, instrumentation on the seafloor in Monterey

Acoustic communication networks, with nodes both anchored under the sea and floating on the surface, will allow robot subs to share data with one another and with scientists on land. The vehicles will then be able to perform tasks in a range of areas, including oil production and fishery management.



Canyon, off the coast of California, sends chemical and seismic data over the Internet communication network to scientists in their offices. As ALAN technology matures and demand increases, networks like these will become more common and will make future underwater exploration using AUVs an attractive option. This past spring, in fact, a small ALAN was deployed in the Alaskan Beaufort Sea to assist *Odyssey* in its research on sea ice.

Artificial Senses

AUVs and ALANs form two legs of the technology triad that will allow us to probe the ocean environment on a grand scale. The crucial third leg consists of the probes themselves—the array of chemical and biological sensors, acoustic imaging devices, and physical measurement tools that robotic vehicles will carry into the deep. In contrast to today's sampling methods, where scientists make point-by-point measurements and must accept long delays between sites, AUVs equipped with suites of sensors will be able to make continuous fine-scale surveys of the oceans. They will map chemical concentrations and temperature gradients that are critical to understanding oceanic dynamics but impossible to study using the present sparse measurements.

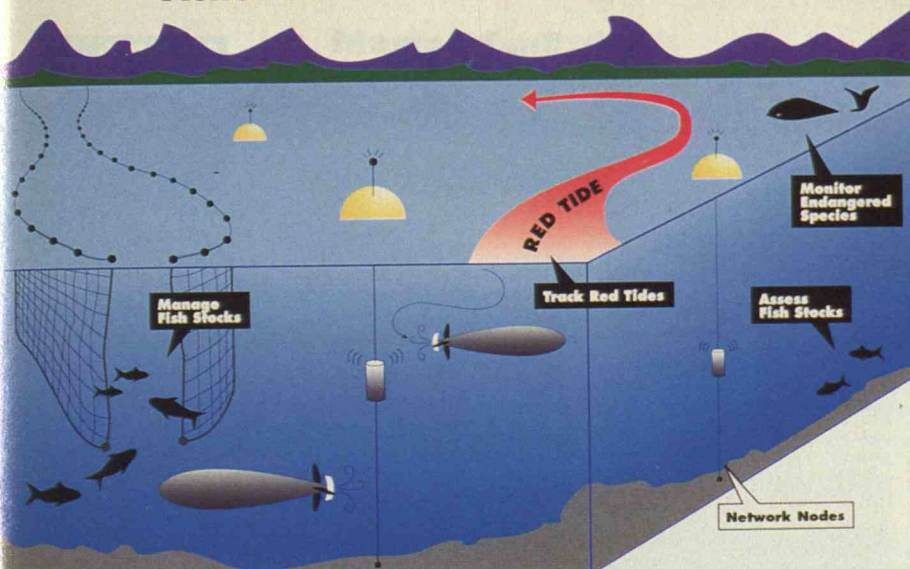
Studying underwater chemical processes is more complicated than simply sticking off-the-shelf laboratory equipment on AUVs and turning them loose. Chemical analyzers designed for use in the laboratory are based on room temperature and pressure, and often involve large quantities of reagents. Sampling and analyzing sea water

6,000 meters down will require new procedures that can be done at 1°C and at pressures of 600 atmospheres. To conserve space and power, an AUV will also be able to carry only tiny quantities of reagents. So far the most likely candidates for AUV-borne sensors are ones designed for use in another hostile environment, the human body. One potentially useful device is a fiber-optic probe developed by David Walt at Tufts University for measuring dissolved CO₂; the tip of a tiny glass fiber is coated with a chemical that changes its reflectivity in the presence of CO₂. Another device that could be adapted for use in the deep oceans—a chip-based sensor designed by D. Jed Harrison at the University of Alberta—can distinguish different amino acids, and would therefore be able to detect a wide variety of biological materials.

Unlike chemical analysis, acoustic imaging technology—sonar—is already well developed for underwater use; research vessels routinely tow sonar equipment close to the ocean bottom to map the seafloor. But AUVs promise to speed up this laborious and cumbersome process. Because ships drag sonars along on a tether that is several kilometers long, they must limit their tow speed to about 1 knot. It takes ages to cover any significant area of oceanic real estate. With the greater speed and agility of AUVs, however, sonar mapping of the oceans may eventually approach the resolution and broad coverage that radar has provided on land and on other planets.

To extend scientists' picture of oceanic processes, many autonomous physical oceanographic instruments are now available and can be mounted on AUVs. The

Fisheries



next generation of *Odyssey*, for example, will carry equipment for measuring conductivity, temperature, and depth. One new tool being developed by A.J. Williams at Woods Hole Oceanographic Institution acoustically measures turbulence on small scales—say, one meter square. These measurements could greatly enhance our knowledge of how turbulence near the surface affects the exchange of chemicals between air and sea—a process that is thought to play a role in determining the oceanic and atmospheric climate. This and other oceanographic instruments are designed to be placed on moorings, where size is not a major consideration, so they would have to be miniaturized for use on AUVs. But perhaps more important, they already use little power.

Beyond Pure Science

While such technologies can enhance our understanding of the oceans immeasurably, their uses for pure science are really just the tip of the iceberg. The possibilities for other applications are numerous:

Mineral resources. Although AUVs could be instrumental in tapping any of the ocean's vast mineral resources, the most obvious industry with which to begin is petroleum. AUVs could assist in virtually every stage of production. The first stage, acoustic surveying of drilling sites, is a labor-intensive process, requiring surface ships to tow sonars slowly at a variety of depths over a long period of time. A fleet of AUVs could cover a broad area quickly, and according to estimates by Applied Remote Technologies in San Diego, even a single vehicle could do

the job at about a quarter the cost of surface ships.

Once the areas of interest have been surveyed, seafloor production facilities and pipelines need to be put in place. Today, some seafloor production at sites such as Texaco's Deepstar facility in the Gulf of Mexico is done by tethered vehicles controlled from the surface. With the aid of an underwater cellular network and satellite links, AUVs could take over these production tasks, operated remotely from a desk at a central station almost anywhere.

AUVs could also aid in maintaining pipelines. The Gulf of Mexico alone contains over 100,000 kilometers of oil and

gas pipeline. Some of this pipe is old and leaky. Some of it is even lost, since storms can move the midsections of pipe hundreds of meters away from their original site. A team of AUVs, each working a different part of the pipeline field, could begin by accounting for all the pipe and charting its location. The vehicles would then conduct routine inspections for leaks and unsupported spans, which can result from washout during storms. The AUV inspectors would surface only for servicing—say, semiannually.

The vehicles would transfer data and recharge underwater at special docking facilities on oil platforms. Michael Feezor at Electronic Design Consultants is now developing such a facility for the Office of Naval Research. Although the prototype does not transfer data or electric power fast enough for a practical AUV system, it offers a glimpse of what might soon be achieved. Ultimately, a system of 15 to 20 AUV inspectors using docking facilities in the Gulf might be able to survey all 100,000 kilometers of pipe every month.

Fisheries. AUVs could also act as underwater rangers, tracking sealife in ways that are difficult or impossible otherwise. They could, for example, monitor fish stocks to prevent overfishing. Today this is done with sonar, which yields only a crude estimate of fish biomass and is barely able to distinguish species, let alone schools of the same species. A more direct way of monitoring fish stocks would be to tag individuals in a school with acoustic beacons, much like bird banding. An AUV ranger would monitor feeding activity and locations, photograph individuals, and—homing in on a particular school with the aid of the tagged fish—use sonar to

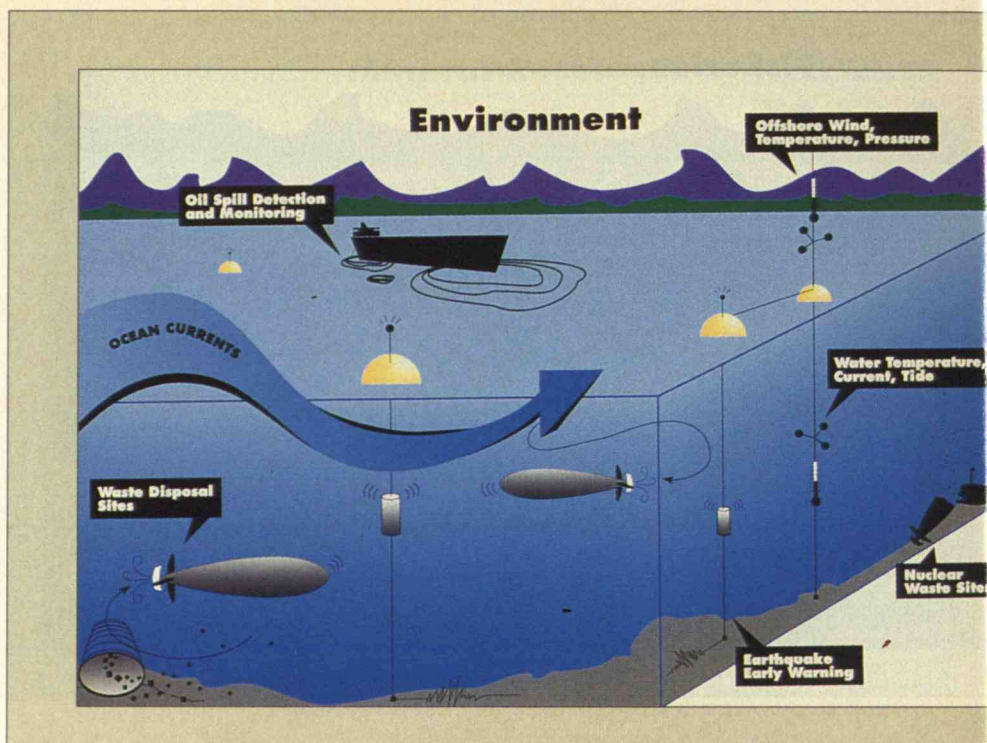
estimate the school's biomass and hence the population and health of the fish. Officials at a central facility could then directly assess fish stocks and set fishing quotas with some confidence.

Shellfishing is another area that would benefit from AUV rangers. To prevent consumers from getting paralytic shellfish poisoning, shellfish beds today are continuously sampled by hand to make sure they are not contaminated with toxic algae. By the time shellfish are shown to be toxic, a certain number have been harvested and sold. But AUV rangers equipped with probes for detecting toxic algal blooms could patrol coastal waters, allowing wardens to close and open shellfish beds with a far greater margin of safety.

AUVs could even be used to create a new form of fish farming. Again using fish tags, AUV shepherds could herd schools from grazing ground to grazing ground, much as human shepherds do with their flocks, allowing a given environment to rebound. The herding device could be noise, which is already used to force fish away from industrial water intakes. When the school becomes mature, the AUV could herd the fish toward a net, where they would be harvested and then sent to central locations for processing.

Environment. Just as AUV rangers would scout available fish stocks, some might be equipped to monitor endangered species. This would be particularly easy for vocal species such as whales and seals, which can often be tracked individually by their calls. An AUV ranger could identify individuals not only with acoustic detectors but also with close-range photography. The rangers would then relay data on populations and movements to scientists.

Part of the pressure on endangered species comes from pollution in the oceans—yet another area where AUVs could contribute. Oil spills come in many sizes; we hear about the big ones: millions of gallons in Prince Edward Sound, for example. Yet comparable quantities are released each year in small spills, which often occur during normal loading and off-loading of tankers even when safety procedures are strictly adhered to. To monitor the state of ocean oil pollution, chemical sensors onboard AUV rangers could measure the concentration of various petroleum fractions in the water and generate pollution maps. These maps would help iden-



tify hot spots, not only permitting prompt cleanup but also singling out locations where better loading procedures or technology could reduce spills.

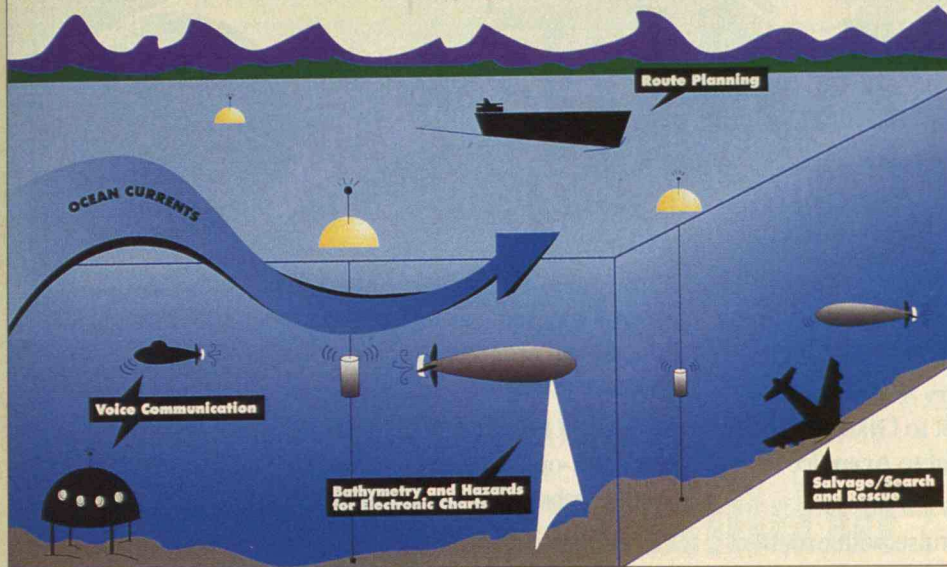
Another pollution problem is radioactive waste. The waste that has been dumped legally needs continuous monitoring. Waste that has been dumped illegally needs to be hunted down. AUV rangers could perform both of these tasks, and could track the dispersal of radioactive material from such sites into the environment. If an AUV discovered a new dumping ground, it could transmit this information to relevant agencies, which could then send back instructions on how to proceed—say, whether to map currents in the area or whether to monitor the distribution of radioactivity.

AUV rangers could also monitor industrial, utility, and sewage outfalls. The vehicles could give feedback to plants, allowing them to fine-tune their operations for the least impact on the ocean environment.

One potential environmental use of AUVs affects everybody: predicting the weather. A major reason forecasts are so poor beyond a few days is the lack of data from below and just above the oceans. Many of the oceanographic sensors being envisioned for AUVs will measure physical characteristics—such as temperature, surface and subsurface currents, and wave heights and direction—that affect weather. ALAN nodes could also be outfitted with meteorological monitoring packages. Data from the vehicles and the nodes could then be relayed to weather bureaus.

Information gathered in this fashion could also help scientists understand the long-term effects of the oceans

Marine Operations



In environmental monitoring and marine operations, underwater communication networks could be used not only in conjunction with AUVs but independently. For example, scientific instruments could be attached directly to network nodes, which would transmit measurements to land. The nodes could also provide voice communication between privately operated submarines and shore.

on global climate change. Tools for measuring salinity, internal wave structures, and turbulence could be added to the battery of physical sensors on AUVs to fill critical gaps in our knowledge of ocean dynamics.

Marine operations. I use this term as a catchall for a variety of miscellaneous uses to which AUVs and ALANs lend themselves. One such application is updating navigational charts. For example, AUVs could provide mariners with timely information on shifting sand bars or recent wrecks that pose navigational hazards—information that could be used to update electronic charts available from the Coast Guard.

Similarly, the vehicles could generate maps of regions of high current, such as the Gulf Stream, for shipping lines. Captains may find it cost-effective to go a slightly longer distance to avoid a strong head current or to catch a strong following current.

AUVs could also help out in the event of accidents at sea. They might use their sonar to search for a missing aircraft or vessel on the seafloor. The robot subs might search for a downed craft's "black box," often the most important item since it contains recorded flight information. Once a crash site was located, an AUV could be outfitted with equipment to communicate with the black box and could transfer the data without actually bringing back the box. The AUV could then either transmit the data to flight agencies over an ALAN or simply return with the recorded info. If a salvage operation were called for, the AUV could aid in planning by providing information on seafloor terrain and currents at different depths.

Overcoming Inertia

The potential uses for AUVs and ALANs are limited only by the imagination. But the picture painted here is optimistic, for the road to achieving this dream is neither smooth nor straight. Besides the unresolved technical issues of power, navigation, and control, another impediment looms in the path of these new technologies: cultural inertia against anything new.

The idea of robots roaming the ocean independent of human control is a radical idea for people who must depend on information from such systems. Their caution stems partly from the fact that, until now, oceanographic equipment has been costly to field; thus every effort has been made to ensure its safe return. For the new ocean technologies described here, the story is different. With large numbers of inexpensive vehicles collecting data, the loss of any single vehicle will be minor, both in its impact on information and in cost. In other words, the vehicles will be expendable. We obviously don't want to litter the ocean with dead AUVs, but a few losses will destroy neither a research program nor the environment. Once the oceanographic community accepts this idea, more funding for fundamental research on such new ocean technology will be forthcoming.

Although AUVs with modest capabilities have been available for many years, researchers have only recently been able to deliver vehicles for use in large-scale ocean systems. Successes with *Odyssey* and similar vehicles should prove that this technology is finally maturing, and foreshadow its vast potential. ■



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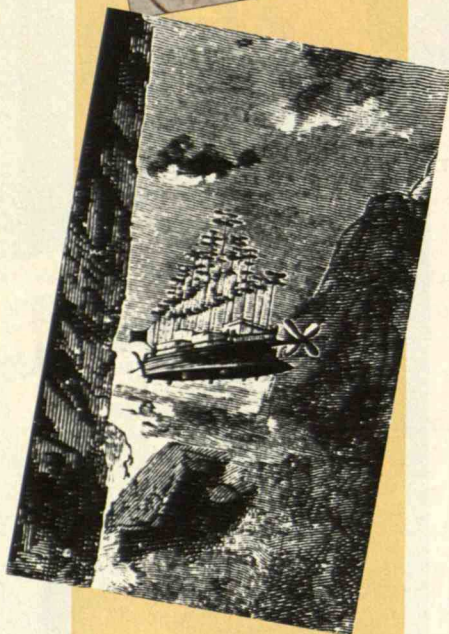


SCIENCE FICTION: Stepchild of Science

However fantastic science fiction might seem, it draws much of its inspiration from science itself—and vice versa.

BY FREDERIK POHL

SCIENCE fiction has come a long way since the days of my youth, when readers were likely to hide a magazine inside a copy of the *Police Gazette*. Now science fiction books often turn up on the *New York Times* bestseller list, and science fiction films are well represented among the blockbusters from Hollywood. Nevertheless, when one scientist wants to denounce another's theories, the killing blow is often to describe them as "mere science fiction."



Hugo Gernsback (top), publisher of the world's first science fiction magazine, was heavily influenced by Jules Verne, who took pride in the technological accuracy of his work. This "aéronef," featured in Verne's novel *The Clipper of the Clouds*, would, as far as he knew, actually fly.

Hugo Gernsback would have hated that. Gernsback, a Luxembourg-born inventor, began a career as a magazine publisher after coming to America in 1904. In April 1926 he brought out the world's first true science fiction magazine, *Amazing Stories*, making him the godfather of modern science fiction (the field's principal awards, the Hugos, are named after him). Gernsback cared deeply about science, especially insofar as it was useful in creating new technologies. The way to write Gernsback science fiction was to imagine some invention and build a story around it. Better still, imagine a whole flock of inventions, as Gernsback himself did in his most famous novel, *Ralph 124C41+*. *Ralph* envisions developments such as television, radar, and space travel.

Gernsback's influence was Jules Verne, and indeed he acknowledged his debt by decorating the contents page of his magazine with a picture of Verne's tomb at Amiens. Verne prided himself on the technological accuracy of his novels, decrying the free-ranging imagination of the upstart H. G. Wells; he contrasted the sensible way he transported his own characters to the moon (fired out of a giant cannon) with the imaginary antigravity shield Wells employed for the same journey. There was nothing "mere" about the science in Gernsback or Verne science fiction. Rather, it was the fiction part that was relatively unimportant, though it did provide a lot of exciting action.

Yet Gernsback's ambition extended far beyond getting his scientific and technological facts straight. He believed that what he called "scientification" served a socially useful purpose. It would, he thought, educate its readers in scientific facts, and inspire them to researches and inventions of their own. He wasn't entirely wrong.

FREDERIK POHL's most recent science fiction novels include *Mining the Oort* (Ballantine, 1992) and *The World at the End of Time* (Ballantine, 1990). He has won six Hugo Awards.

Fans Who Made History

The honor roll of figures in contemporary science is filled with people who were addicted to science fiction in their youth. Stephen Hawking, current occupant of the chair once held by Isaac Newton at Cambridge University, is one, confessing that he spent his first few university years reading science fiction rather than his texts; Marvin Minsky, who won the Japan Prize a couple of years ago for his life-long contributions to the study of artificial intelligence, is another. Minsky credits such science fiction stories as Isaac Asimov's *I, Robot* and Jack Williamson's *The Humanoids* with awakening his interest in the prospect of intelligent robots. In fact, one of his first projects at MIT's Artificial Intelligence Laboratory was to attempt to program Asimov's "three laws of robotics" into an actual computer.

Then there were the teenagers at New York's Bronx High School of Science in the 1950s. Among them was Sheldon Glashow, who, with two others, formed an active fan group, putting out the school's science fiction "fanzine" and taking part in campus dramatizations of science fiction stories. "I went from comic books to science fiction, which probably was as important as anything else in getting me interested in science," Glashow reminisces. A decade or so later, he and Steven Weinberg, who had also belonged to the fan group, developed the "WSG electroweak" theory, which unites electromagnetism with the weak force that governs some nuclear interactions. Their partner in the WSG model was Abdus Salam of the International Center for Theoretical Physics in Trieste, and for that work the three shared a Nobel Prize in 1979.

Indeed, the influence of science fiction on actual scientists may have been even greater than Gernsback imagined, at least in some areas. Leo Szilard partly credits H.G. Wells's early science fiction story about atomic energy, *The World Set Free*, with the inspiration that led him directly to the Manhattan Project—and the world to

its present nuclear anxieties. Living in London at the time, Szilard had read a newspaper statement by one of the grand old men of English science to the effect that nuclear power was a fantasy. Later that day, while Szilard was waiting for a traffic light to change, Wells's visionary story popped into his mind, along with the notion that a neutron chain reaction could release surplus energy from fissioning atoms. A few years later Szilard and others built a primitive nuclear reactor under the Stagg Field grandstand in Chicago based on just such a concept.

Even more concretely, the world's space programs were largely sparked by such science fiction fans as rocket engineer Werner von Braun, who during World War II kept up a subscription to his favorite magazine, *Astounding Science Fiction*, through a mail drop in neutral Sweden. Less traditional disciplines like futurology and the search for extraterrestrial intelligence have even deeper roots in science fiction. SETI could hardly have been imagined without the suggestion in a thousand science fiction stories that there might well be some extraterrestrial intelligences out there to search for, and futurology has often made great use of specific science fiction stories. At the Hudson Institute futurological think tank, the late Herman Kahn, a leading figure in forecasting methodology, assigned a post-doc to the task of reading through the entire works of such science fiction writers as A. E. Van Vogt and listing their predictions.

Like von Braun, many scientists maintain their interest in science fiction throughout their lives, and some have gone so far as to write science fiction of their own. Leo Szilard published a volume of short stories called *The Voice of the Dolphin*; wry, satirical commentaries on the politics and social institutions of the twentieth century, they are also indisputably science fiction. Cosmologist Fred Hoyle's first science fiction novel, *The Black Cloud*, which speculated about intelligent life arising in an interstellar gas cloud, gave him so much pleasure that he went on to add a string of other

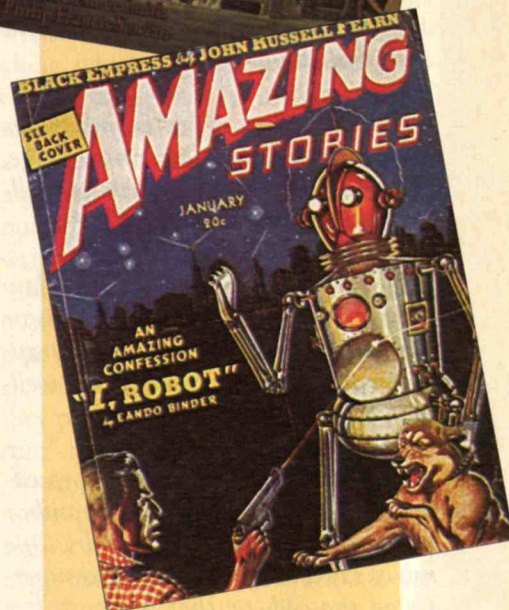
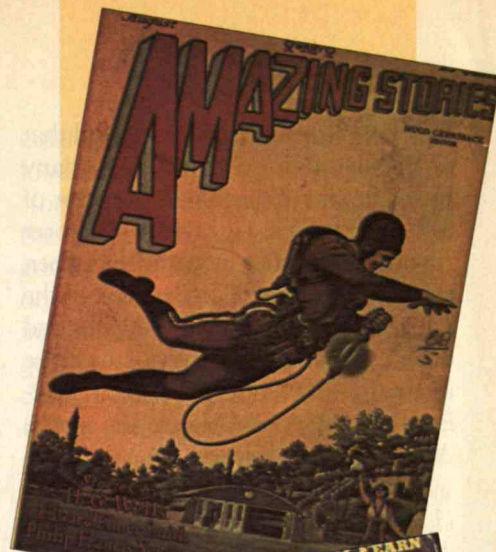
novels. Astronomer Carl Sagan's best-selling novel *Contact* reflects his interest in communication with aliens, and Marvin Minsky's science fiction technothriller, written in collaboration with science fiction writer Harry Harrison, fleshes out speculation about storing human intelligence in machines.

Even O.R. Frisch, codiscoverer of the neutron fission reaction, once ventured into science fiction to make a political point about nuclear power; his short essay "Report on the Feasibility of Coal-Burning Power Stations" is a deadpan joke, set in an alternate world where technology has taken some different paths. The "report" describes the horrendous dangers of generating electricity by burning fossil fuel, and argues that impractically immense balloons would be needed to capture the dangerous stack emissions.

Indeed, quite a few of science fiction's most prolific writers are scientists in their day jobs. Some are mathematicians like the late Eric Temple Bell, who wrote many swashbuckling science fantasies in the 1930s under the pseudonym of John Taine, and Vernor Vinge of San Diego State University, whose *A Fire Upon the Deep*, a wonderfully inventive account of struggles between superhuman intelligences, won a Best Novel Hugo Award in 1993. Edward E. "Doc" Smith, whose galaxy-ranging 1929 novel *The Skylark of Space* paved the way for the film *Star Wars* and all its kin, had a doctorate in chemistry and an occupational specialty in food chemistry, particularly grains. And Isaac Asimov, the grand master of science fiction, held a doctorate in biochemistry—although, as anyone who knew Asimov or his works can testify, his primary field of expertise was actually everything.

Reconciling Imagination with Doctrine

Since science fiction does tend to incorporate phenomena no one has ever experienced, writers need to take some liberties, however devoted they



Scientists are among science fiction's most prolific writers and avid readers. Top: Chemist

E. E. Smith wrote *The Skylark of Space*, the cover story of the August 1928 issue of Gernsback's magazine.

Bottom: The cover story of the January 1939 issue, one of the first attempts to tell a tale from a robot's perspective, typifies the literature that helped inspire artificial-intelligence pioneer Marvin Minsky.

[illegible]

Werner von Braun, who became a key player in the world's space programs, designed this "rocket

wagon" as a 16-year-old science fiction fan. Von Braun maintained a life-long interest in the genre, keeping up a subscription to *Astounding Science Fiction* during World War II through a mail drop in neutral Sweden.

But even the most conscientious authors run into trouble when scientific opinions change. A generation or two ago, science fiction stories were filled with inhabitants of planets in our solar system—ETs such as squat, immensely strong Jovians and willowy, sunburned-black creatures from the planet Mercury—for better telescopes and visiting spacecraft had not yet ruled out the possibility that beings like these existed. If Ray Bradbury and, particularly, Edgar Rice Burroughs allowed their characters to have adventures with Martians, they

As scientists have shown that this solar system's planets are unlikely habitats for intelligent aliens, writers have gone farther afield to supply their fiction with such beings. Granted, Einstein's speed limit for space travel—the speed of light—is now canonical, yet thanks to the speculations of astrophysicists and cosmologists like Kip Thorne and Stephen Hawking, characters can hop from star to star in an afternoon through “space warps” or “wormholes” between black holes and white ones. Or they can rely on that wonderfully useful theoretical particle, the tachyon.

Unfortunately, even in theory, tachyons cannot propel a spaceship built of normal matter, but that doesn't make them useless for science fiction. Like any stream of particles, tachyons might carry information—perhaps coded assembly instructions that could be used to build an exact duplicate of

something from earth around the star Alpha Centauri, or for that matter somewhere in the Andromeda nebula. That something might even be a copy of a person, once the problems of locating and identifying every molecule in the human body are solved.

Another stratagem for interstellar travel is Einstein's phenomenon of time dilation, in which at speeds close to that of light, time passes so slowly that voyagers can cross a galaxy before lunch. And then there's "frozen sleep." The basic concept of immortality through freezing was proposed in the early 1960s by Robert C. W. Ettinger, a science teacher from the Detroit area. Will it work? The jury is out. But for the purposes of science fiction, the possibility alone is enough. Star travelers can be popped into the deep freeze on takeoff and defrosted when they've reached their destination—ten years later or a thousand.

The worlds these characters can visit have also become more interesting with the help of scientific speculation. Freeman Dyson's notion that an advanced civilization might solve its energy needs by enclosing its star in a vast, energy-trapping shell has inspired a number of science fiction stories, notably Larry Niven's *Ringworld*. Even Fred Hoyle's steady-state universe, a cosmology now known to be unlikely, was good while it lasted, giving science fiction writers, including Jack Williamson and myself in *The Reefs of Space*, the opportunity to create some colorful settings. The theory was that the universe had neither beginning nor end but continually increased through the spontaneous creation of new matter, and we proposed that this new matter out in space might form itself into complex structures inhabited by unearthly creatures.

Preventing Future Shock

To be sure, science fiction includes reams of comics and pulp adventures and an endless flood of monster movies and silly TV shows. Yet even in film and television there are some who

try to keep their honor bright. For instance, the producers of *Star Trek* now employ a scientist full-time to check their scripts for scientific howlers. Perhaps that newfound care is why, in a 1993 episode, Stephen Hawking himself did a guest shot on the show, in the company of holographic simulations of Albert Einstein and Isaac Newton.

Interestingly, though, science fiction is not fiction about science, despite all the attention writers often lavish on the science in their tales. Indeed, some of the best—the works of such masters as Harlan Ellison and Ray Bradbury—have no detectable science in them at all. Science fiction is about something much more fundamental, as Arthur C. Clarke must have realized when he said that he wrote science fiction "because no other kind of literature concerns itself with reality."

The foremost reality that science fiction deals with is change, which could be the reason for the growing interest in the genre in the twentieth century, when the world has experienced more change than ever before. When science plays a significant part in science fiction, as it surely does, it is primarily as one of the instruments of change. Science fiction is the sovereign prophylactic against future shock, so that if you read enough of it, nothing will take you entirely by surprise.

Not that science fiction writers intend to predict the future. The idea is simply to investigate possibilities—sometimes with the goal of sounding a warning, as George Orwell did in 1984. When Ray Bradbury was asked whether he expected the future to be like the nasty one he described in *Fahrenheit 451*, he answered, "I don't try to predict the future. All I want to do is prevent it."


So what, in the final analysis, is this thing called science fiction? There isn't a good answer. Many attempts have been made to define it, but none are entirely satisfactory. The best one I know is by the late English science fiction writer John Phillipfent, who once wrote me in some elation to say that he had finally figured out what distin-

guishes science fiction from all other kinds of writing. Every science fiction story, he said, is written by means of the "science fiction method," analogous to the "scientific method"—the orderly system of information gathering and theory formulation that distinguishes science from random anecdote. Unfortunately, Phillipfent died without ever specifying just what that science fiction method was, but I nevertheless believe he was right. There is such a method, and science fiction writers have been employing it all along, whether consciously aware of it or not. It consists of looking at the world around us in all its parts, taking some of those parts out and replacing them with invented ones, and then putting the model back together and writing a story to show how it works.

Sometimes that process is socially useful. Science fiction does demand that its readers develop a larger perspective on the planet—demands that they ponder "the view from a distant star," in astronomer Harlow Shapley's phrase. And there may soon be even more proof for Hugo Gernsback's claims about science fiction as pedagogy. In another paper delivered to the AAAS meeting, Hal Coyle, now in the science education department of the Harvard-Smithsonian Institute for Astrophysics, described how he used *Star Trek* to help convey scientific concepts to high school students in his first postgraduate job as a science teacher. Klingons and other aliens opened the door to a discussion of evolution, and the *Starship Enterprise's* great speed and maneuverability sparked interest in Einstein's theory of relativity and Newton's laws of motion. The planets the ship visited helped students understand stellar types and the scale of the universe.

But none of that would have worked if it had not been for science fiction's other major trait. It may teach. It may inspire. Still, most of all what it does, for many millions of people around the world, is to let them explore, from their armchairs, places and times they can never visit in the flesh. It is, in short, fun. ■

Off the Track



THE idea of sticking a budding Shakespeare or Einstein in with a class full of students who can barely read or add seems counterproductive at best, and perhaps even cruel. Advocates for gifted children therefore argue that schools should sort students by ability, a process known as tracking. The proliferation in U.S. schools of mixed-ability classrooms, they say, has led to a "dumbing down" of the curriculum, alienating many of the country's best and brightest students.

Sally M. Reis, an educational psychologist at the University of Connecticut and an advocate for gifted education, recently put forward a compelling presentation of this view in this magazine ("How Schools Are Shortchanging the Gifted," *TR* April 1994). Reis complained that the U.S. educational system "has turned away from ability-based grouping" with the result that high-ability students are woefully "underchallenged" and their talents left "unnurtured."

What Reis doesn't say is that tracking remains close to ubiquitous in this country: 88 to 90 percent of U.S. public

*Tracking
schoolchildren according
to their ability levels doesn't
help students at either end
of the scale.*

schools already group students by ability, estimates Robert Slavin, an educational psychologist at Johns Hopkins University. And claims that even tracked students spend most of their time in mixed-ability groups ignore the large portions of the school day consumed by such non-academic activities as recess, lunch, art, music, health and sex educa-

tion, and general administrative housekeeping such as attendance checks. Factoring this time out of the calculation produces a picture of schools where tracking of academic subjects is the rule, not the exception: indeed, if high-ability students are languishing, they are languishing on the fast track.

Meanwhile, the bulk of evidence shows that tracking does little if anything to enhance learning. In a recent study of the research on ability grouping in elementary schools and tracking in high schools, Slavin found no discernible positive effects on achievement. And administrators who have managed to eliminate tracking in their schools report that the performance even of high-ability students frequently improves in mixed-ability groups.

Why would high-achieving students do better in a mixed classroom where less gifted children slow the pace and lower the sophistication of instruction? Perhaps because students trapped in high-achieving groups often worry more about getting the right answer than they do about learning. "Kids in the top tracks stop taking risks," says Ann Wheelock, author of *Crossing the Tracks: How Untracking Can Save America's Schools*. "They think that if they make mistakes, they will get boot-ed into a lower track, so they play it safe. This attitude is not conducive to creative thinking, or to learning."

While of dubious benefit to high achievers, tracking is unquestionably harmful to students classified as less able. This is largely because teachers' goals and expectations correlate almost exactly with the track the students are on. As educational theorist John Goodlad describes in his book *A Place Called School*, students on the lower tracks are assumed to be less ambitious and less motivated, and to have a less promising future than students on the fast track.

Jeanne Oakes, a professor of education at the University of California at Los Angeles and author of several books on tracking, asked teachers what they thought were the five most important things their students should learn in a

given year. High-track teachers stressed competent and autonomous thinking while low-track teachers stressed low-level skills and conformity to rules. Not surprisingly, few teachers want to teach low-track classes. Many secondary schools hand out high-track classes as rewards to the best or most experienced teachers; low-track classes are a kind of booby prize inflicted on new or less-favored instructors.

A Caste System

This is not to say that all grouping is bad. Students do not all learn at the same rate, and some require more help with basic skills than others. Even the most vocal opponents of tracking grant that the small minority of children that can be classified as truly gifted—perhaps

3 to 5 percent of the total school population—may well require special attention to fulfill their potential. And all students can benefit from highly flexible groupings formed to master specific skills, especially if these groups cut across grade levels. Math, in particular, lends itself to this approach. A mathematically precocious 6-year-old could, for example, study fractions with a classroom of third and fourth graders. The trick is to keep the groups fluid, with students able to move in and out as their interests and competencies change.

Unfortunately, tracking as it is currently practiced in U.S. schools is in effect a caste system, with boundaries clearly drawn and difficult to cross. The group becomes a student's identifying characteristic; a child relegated to a lesser reading or mathematics group thinks of

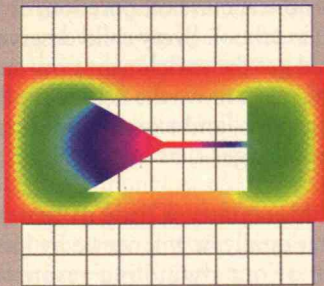
himself or herself as a lesser mathematician or reader, and teachers regard a student's group identification as an indicator of learning capacity.

Children in lower-level groups are given less information in context and less opportunity to integrate what they learn in class with what they know of the outside world. Instead of written assignments and open-ended problems, they get worksheets and rote tasks. It's no wonder, then, that students in low-ability groups hold a more negative attitude toward school and learning than do other students.

Too often, tracking becomes an institutional framework for self-fulfilling prophecy. Low-track students tend not to get exposure to ideas that may catch their interest, enrich their lives, or launch them academically. Students in low-

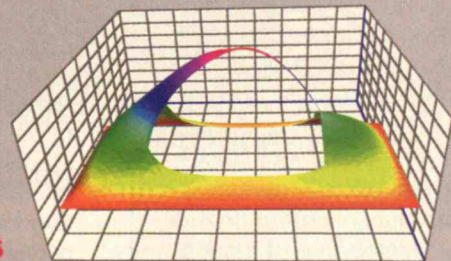
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track mathematics, for example, typically do not take algebra early enough to squeeze in calculus or even pre-calculus during high school—an omission that creates a sometimes insurmountable barrier to pursuing a career in science or engineering.

Reis argues that high-ability students are exploited in mixed classrooms, where, she says, they are forced to work as unpaid tutors of lower-ability children. But students from a wide range of academic backgrounds profit from such cooperative classrooms. Indeed, high-achieving students seem to benefit the most, perhaps because, as one high-school English teacher told me, these advanced students are forced to articulate, and therefore justify, their thinking processes. One of the surest ways to cement one's own understanding of a concept is to explain it to someone else.

Innovation by Elimination

Reis claims that the decline in the number of U.S. students in graduate programs in science and mathematics somehow indicates the failure of our system to reach its most capable students. But as former Harvard University president Derek Bok laments in his recent book *The Cost of Talent*, many of the nation's brightest college graduates have turned away from careers in science and mathematics not because they can't hack them, but because they perceive careers in medicine, business, or the law to be more profitable. (Applications to medical school have soared in the last year.) Standards at elite undergraduate institutions have risen considerably over the last two decades. Donald Kennedy, former president of Stanford University, noted recently that "Stanford students are significantly brighter and better-prepared than their 1977 counterparts."

Moreover, the foreign students crowding U.S. graduate programs in mathematics and science were probably not tracked at all in grade school, and possibly not in high school. The highly

touted Japanese school system, for example, does not group children by ability until eighth grade—which may explain why the average seventh grader in Japan performs as well on math tests as high-track eighth graders in the United States.

The very lack of tracking has, arguably, helped the average European student to outperform the average American student on standardized tests. "In Europe, every student is expected to get through math, and that expectation reflects on the way the subject is taught," says Irwin Blumer, superintendent of schools in Newton, Mass., where students are tracked in junior high. If European kids are having a hard time with a subject, he says, "the teachers look back at the way it's being taught to find the problem; they don't assume the kids can't handle it."

No one would contest that the U.S. educational system is in dire need of improvement. Too many class periods are spent going over the same material again and again. There is an overemphasis on rote learning. Many textbooks are boring, even sophomoric. But the gifted have no franchise on boredom or alienation in school. Every child deserves and should get the enrichment now enjoyed by the select few—the field trips, discussion groups, and experiential learning, the challenges that make school come alive.

If this country is truly to "catch up" educationally, it will not be by focusing more of our dwindling resources on those students who have consistently shown themselves able to rise to the top with relative ease. It will be by ridding ourselves of the outdated, unfounded, and un-American notion that only a minority of children can learn on a high level, and by treating all children with optimism, enthusiasm, and care. ■

ELLEN RUPPEL SHELL, an associate professor of journalism and co-director of the program in science and journalism at Boston University, is author of *A Child's Place: A Year in the Life of a Day Care Center* (Little, Brown and Co., 1992).

Overpopulation Alarm

As regular readers of this column know, I am inclined to be optimistic in the face of technological challenges. No matter how daunting the technical obstacle, I, like many engineers, instinctively presume that human resourcefulness will be equal to it. This faith in ingenuity stems largely from a lifetime in which engineering solutions have had a way of appearing on the scene when needed—often imperfect and carrying within them the seeds of new difficulties—but solutions nevertheless.

Reassurances come daily. A report from Paul E. Waggoner of the Council for Agricultural Science and Technology predicts that with “smarter farming,” crop yields can vastly increase while at the same time much land can be returned to the wild. In India, the adoption of high-yield grains has already enabled farmers to “spare for nature” more than 100 million acres that otherwise would have been plowed and planted. On the energy front, engineers at the University of New South Wales in Australia have developed a new solar-cell design that combines the high photovoltaic efficiency of silicon crystals with the low cost of impure, noncrystalline silicon—promising to cut costs by 80 percent.

As we devise benign technologies that generate plentiful energy and food, we gain optimism about our ability to preserve the environment. A recent book issued by the National Academy of Engineering called *The Greening of Industrial Ecosystems* features essays on “industrial ecology,” including ideas on using wastes as raw materials, designing for the environment, and preventing pollution. By joining ecological consciousness to engineering genius, we can save the environment. It takes confidence verging on hubris to think along these lines, but the can-do attitude is deeply ingrained in the engineering psyche, and not without some justification.

Yet a large and menacing problem casts a shadow over this splendid parade of accomplishment—overpopulation. There are now 5.7 billion human beings on earth, twice as many as in the late 1950s. Experts fear that the figure could

more than double by the middle of the next century. Doubtless there are some people, engineers included, who believe that we can cope with even that drastic growth. I am not among them.

Confronted with the prospect of exponentially increasing numbers of humans, my optimism is abruptly transmuted to alarm. My intuition tells me to believe United Nations demographers and other authorities who predict that if population is allowed to grow unchecked, famine, wars, and unspeakable suffering will overtake the world. I fear that engineers, no matter how clever, will be overwhelmed by the need to feed too many mouths, to heat too many dwellings, to power too many factories. Scientists and technologists are racing to discover knowledge and invent machines that will make people's lives easier and more rewarding. But as the population burgeons out of control, the

grams that have developed over the past 25 years. In most industrially developed parts of the world, fertility rates are already below the replacement level of 2 children per woman. In developing nations, birth rates have been lowered from over 6 children per family in the 1960s to about 3.5 children today. Roughly half this decline is attributed to the use of contraceptives, which in developing nations has grown fivefold over the past several decades, standing now at 55 percent of married couples.

But family-planning programs alone will not solve the population problem. Experts stress the importance of many interrelated issues, such as sustainable economic growth, universal access to health services, reduction of infant and child mortality rates (lessening the need for large families), education and job training, and—a concern of growing force—gender equality and the empow-



goals seem ever elusive.

In the final analysis, it will be the world's engineers who are called upon to save humanity from the consequences of increasing population. Engineers would thus be wise to pay close attention to the results of the Third International Conference on Population and Development (ICPD 94), held in Cairo in September by the United Nations. The goal established by conference organizers is to follow a low-growth path to a world population of a little under 7.3 billion in 2015, and stabilization at 7.8 billion by the year 2050.

ICPD 94 will build on national population policies and family-planning pro-

gram of women. Commitment is essential, both from individual governments and from the world community. Money, needless to say, must also be forthcoming.

In the aftermath of the UN conference, engineers will want to work, both as professionals and as concerned human beings, to fulfill its objectives. We know that the challenges presented by overpopulation will be enormous. We don't want them to be insurmountable. ■

SAMUEL C. FLORMAN, a civil engineer, is the author of *Engineering and the Liberal Arts*, *The Existential Pleasures of Engineering*, *Blaming Technology*, and *The Civilized Engineer*.

When Government Gets It Right

WHAT federal program promotes the development and deployment of critical technologies; fosters collaboration among for-profit, nonprofit, and public organizations; distributes money for R&D, education, and training to companies and regions hardest hit by military cutbacks; and does all this without creating a new top-heavy bureaucracy in Washington? Answer: the Technology Reinvestment Project (TRP), which evolved out of a desire to wean contractors away from excessive dependence on military procurement without recklessly abandoning the national defense.

Signed into existence by a reluctant George Bush in the waning days of his presidency, TRP has taken root and blossomed under the Clinton administration. TRP is a true interagency enterprise: it is administered and staffed by the Department of Defense's Advance Research Projects Agency, the Department of Energy, the Department of Commerce's National Institute of Standards and Technology, the National Science Foundation, the National Aeronautics and Space Administration, and the Department of Transportation, all coordinated by the White House's National Economic Council.

When TRP issued its first requests for proposals in the spring of 1993, it emphasized three sets of activities. One is funding consortia of companies, agencies, and universities that can offer concrete plans for producing new technologies with persuasive potential for commercialization. Another goal is sponsoring state- and community-based manufacturing extension programs that aim to bring smaller companies up to speed. Finally, TRP supports college and university programs designed to retrain engineers and technicians who have lost or face losing their defense-related jobs.

By February 1994—blazing speed by Washington standards—TRP announced 212 winning proposals involving nearly 1,600 organizations. Some participants are supplementing TRP funds with their own. Total spending on the program's projects for 1994-95, including these

non-federal contributions, comes to about \$1.5 billion—small potatoes by federal standards, but still a good start. The second round of TRP contracts is now being awarded.

TRP is focusing on technologies critical to U.S. industrial development, among them medical diagnostics, the detection of environmental hazards, advanced batteries, and object-oriented computer programming. As intended, most TRP money is going to companies and regions that have been hit the hardest by the defense build-down. And practically every government employee working on TRP was already employed by one of the participating agencies; no new bureaucracy had to be created.

Many of the TRP projects involve players that were already working together, often as a result of previous government intervention. For example, California's CALSTART electric-vehicle pro-

ject involving Northeastern University and the public/private Bay State Skills Corp. is training engineers with defense-related specialties in fields such as radar, avionics, and optics to design and develop commercial products and systems—for example, high-frequency wireless communication systems and electromagnetic sensors that monitor the condition of bridges and buildings.

Many experts oppose such efforts, maintaining that defense contractors are hopeless dinosaurs and that it makes no sense to build a swords-into-plowshares program around them. The error in this thinking is that most defense contractors, and even some of the giant prime contractors, are already "dual use"—comfortably meeting the very different demands of the Pentagon and the commercial sector. Besides, as early experience with the TRP shows, dual use often refers not merely to the market



ject has been up and running for several years, with substantial funding from the state as well as from corporate sponsors such as AlliedSignal and Hughes Power Control Systems.

Other projects, however, would not exist without the new federal program. TRP is funding defense contractor Aerojet, for example, to develop commercial applications for aerogel, a new class of materials with extremely good heat-insulating properties. Aerojet and its partners—potential end-users such as General Motors, Admiral, and Boeing—are trying to commercialize this experimental technology one step ahead of foreign competition. In Boston, a TRP pro-

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BENNETT HARRISON teaches economic development at Carnegie Mellon University. This year he is visiting professor at Harvard's John F. Kennedy School of Government.

Reviews

BOOKS

THE UNDERESTIMATED EAST

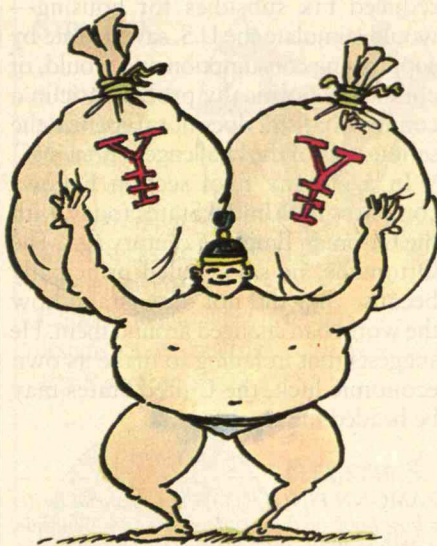
Looking at the Sun: The Rise of the New East Asian Economic and Political System
by James Fallows
Pantheon Books, \$25

BY EAMONN FINGLETON

EVER since the Tokyo stock bubble burst a few years ago, the Japanese economy has been portrayed as a disaster zone by the U.S. press. Humbled Japanese executives are now said to be studying a resurgent United States for clues to get out of their mess.

It is an engaging story. But a reality check has been long overdue. The Tokyo stock market aside, Japan has been performing better in the 1990s than any other major nation, by many important yardsticks of economic health. The strength of the yen, in particular, hardly betokens economic weakness: measured from the end of 1989, when Tokyo stocks entered their sickening slide, the yen is up fully 36 percent against the dollar.

And despite an almost constant chorus of predictions that an "overvalued" currency would trigger massive layoffs in Japan, the nation's unemployment rate is still only 3 percent, the lowest of any major country. Moreover, the bankruptcies in export industries that so many had expected a few years ago have not occurred. Not a single major exporter has gone out of business. Indeed, far from collapsing, Japan's exports have risen by more than 30 percent since 1989. But perhaps the single most surprising aspect of Japan's economy is the irrepressible manufacturing sector. According to the Deutsche Bank, Japan last year passed the United States to become the world's largest manufac-



turing economy. Valued at current exchange rates, Japan's manufacturing output totaled about \$1.2 trillion, versus \$1.1 trillion for the United States.

How could the press have got the story so badly wrong? James Fallows's new book *Looking at the Sun* provides timely insight into both the source of Japan's deep-rooted economic success and the reasons why Japan's strengths are constantly underestimated in the West. The biggest mistake, Fallows argues, has been our failure to understand that the Japanese economic and political system is decisively different from the Western model. The fact is that competition between Japan and the West cannot always be understood in Western terms.

Fallows chooses as his starting place the U.S. semiconductor industry's losing battle with Japan. As he points out, the U.S. industry in 1980 epitomized the tenets of Adam Smith economics: it was unencumbered by pigheaded unions, rampant short-termism, excessive regulation, or any of the other standard ills that free-market economists invoke to explain American decline. Venture capital was flowing torrentially into Silicon Valley, engineers freely moved from one employer to another, new companies mushroomed overnight, and product prices changed daily in response to clas-

sic supply-and-demand pressures. Yet little more than five years later, many parts of this erstwhile economist's Eden were looking like a wasteland, thanks principally to their powerful competition across the Pacific.

In Fallows's view, Japan's rise in electronics was driven in part by a protected Japanese home market, where high profit margins gave companies the war chests to cut prices to the bone abroad. He also notes that the industry was operating at near capacity as a more or less automatic consequence of the *keiretsu* system—Japan's family-like networks of firms. Japanese corporations can count on a large and stable baseload of business from *keiretsu* affiliates even in the teeth of cut-price competition from U.S. and European rivals.

But what helped Japan most was simply capital. Fallows explains that if the U.S. approach boiled down to adjusting prices to maximize sales and profits, the essence of the Japanese approach was "not worrying about theoretical efficiency, not being concerned about the best rules for competition, but focusing only on getting the nation's money into the hands of the nation's big manufacturing firms. If companies could get *more money* to work with than their competitors, then in the long run they would prevail." More money meant better equipment and higher productivity. One by one the Americans were forced to withdraw.

The Japanese car industry is no showcase of U.S.-style free competition, either. The Tokyo ministries set about creating their auto industry in the 1950s by erecting a wall of tariffs and pressuring foreign companies to license their technologies to the fledgling Japanese contestants. Even today, Japan maintains a web of regulations that benefits the domestic industry, most notably a requirement that all cars undergo frequent after-sales tests for roadworthiness. Those tests uncover enough problems to induce most Japanese drivers to buy a new car every three years. What's more, the system generates huge profits for the Japanese car-repair industry, much of which is owned by the automakers.

The Costs of Losing Out

Little of this will come as a surprise to many Japan watchers. But to most members of the American policymaking establishment it still sounds like heresy, and it is at them that Fallows's 517-page work, the product of an eight-year study of East Asian economies, is principally directed.

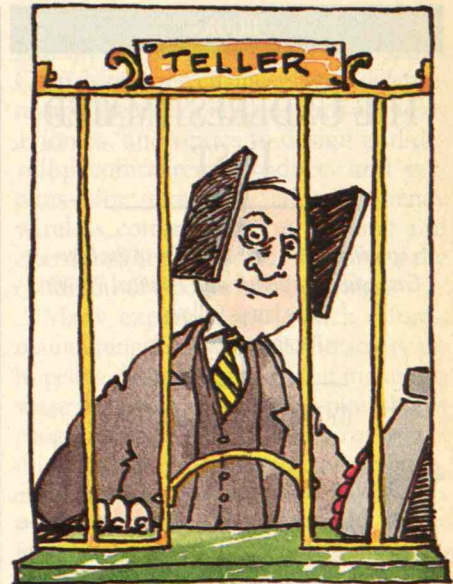
Throughout the book, Fallows brings a wealth of fine detail to his argument and vividly illustrates what it will mean if the United States continues to lose out to Japan. For instance, his account of how a declining U.S. electronics industry could jeopardize national security is startling enough to make even Milton Friedman wonder whether free markets are enough. He cites in particular the predicament of the National Security Agency (NSA), which is in charge of encoding as well as intercepting and decoding messages for the U.S. government. The NSA now depends on Japan for some types of semiconductor manufacturing equipment, and Fallows reports that when asked what would happen if this equipment needed servicing, an agency official replied, "Oh we'd never risk having a foreign citizen [i.e., a Japanese company representative] enter the facility. If we can't fix it ourselves, we'll just throw that piece of equipment out and purchase a new one, even if it means several million dollars for replacement instead of a repair for several hundred dollars."

What should the United States do? In the tradition of most authors writing about Japan, Fallows goes through the motions of offering solutions. For example, he suggests managed trade to help U.S. companies maximize their sales, and elimination of the U.S. budget deficit to boost the savings rate. But it is clear he is not optimistic that the country will get religion in time. If Fallows draws one key lesson from the Japanese experience, it is that government policies could readily be devised to curb the U.S. pattern of insufficient savings, which leads to insufficient capital. Yet his specific suggestions—higher gasoline taxes and

reduced tax subsidies for housing—would stimulate the U.S. savings rate by suppressing consumption and would, of course, be politically problematic in a country that still does not recognize the seriousness of the challenge it is facing.

In a gloomy final section Fallows compares the United States today with the Ottoman Empire a century ago. The Ottomans, he says, failed principally because they did not understand how the world had changed around them. He suggests that in failing to make its own economic luck, the United States may be headed the same way. ■

EAMONN FINGLETON is a financial writer whose book on the Japanese economy, *Blindside*, will be published in 1995 by Houghton Mifflin.



BOOKS

REINVENTING THE BANK

*Mortgaging the Earth:
The World Bank, Environmental
Impoverishment, and the Crisis of Development*
by Bruce Rich
Beacon Press, \$29

BY KATHLEEN COURRIER

THIS year, the institutions created at Bretton Woods to jump-start the global postwar economy turn 50. Stock-taking is inevitable. The International Bank for Reconstruction and Development (the World Bank) and the International Monetary Fund (IMF) have together been a major force for economic growth and modernization in developing countries. "The Bank"—insiders' Kafkaesque moniker for both institutions—has taken credit for boosting life expectancy, income levels, and public health standards by supporting construction of the physical and institutional infrastructure that can enhance international trade. And amid the recent

debt crisis, the Bank has helped curb hyperinflation in some borrowing nations. Arguably, its new loans to Eastern Europe, the former Soviet Union, and other disintegrating economies work the ground for democracy. Yet in *Mortgaging the Earth*, lawyer Bruce Rich of the Environmental Defense Fund says that Bank failures outweigh accomplishments, especially if viewed from ground level.

Rich shows how an institution created in the early aftermath of World War II to further world peace and freedom by nurturing trade-based prosperity took on the colors of its early presidents. Notably, John J. McCloy made the Bank a top-notch lending and borrowing institution by winning Wall Street's confidence, and Eugene Black and George Woods involved the Bank in large infrastructure projects and export-crop agriculture. But "more than any of his predecessors or successors," says Rich, "Robert McNamara made the Bank into what it is today," carrying centralized planning and control of information to new heights, upping pressure on staff to meet ever higher lending targets, and banking on the elite in developing nations to watch out for the poor, the powerless, and the environment.

PUZZLE CORNER

Rich contends that the legacy of the McNamara years is a free-standing colossus, answerable only to its own laws, morally adrift, and indifferent to the havoc its policies and loans visit on poor people and the natural world. In its drive to invest, says Rich, the World Bank has pushed loans on poor countries that couldn't absorb large blocks of capital effectively, and then used the IMF, which makes short-term loans to cover balance-of-payments deficits, to bully those facing default into adopting austerity measures. The result has been cuts in social services and at least temporary unemployment. The pressure to repay loans has also forced debtor governments to sell off natural resources to raise foreign exchange.

If Rich is right, in developing countries the road to hell is paved with grand plans and expensive infrastructure. He describes scores of Bank-funded dams, roads, irrigation works, forestry and agriculture schemes, and energy facilities that didn't deliver as promised but did trigger deforestation, displace native peoples, drive land speculation, spark rural violence, set the stage for epidemics, and unleash other ills. Three of the monumental projects Rich discusses in detail—the Polonoreoste frontier-farming scheme in Brazil, Indonesia's island-to-island "transmigration" program, and the Sardar Sarovar Dam in India—are particularly instructive reminders of how Bank investments can set Faustian mischief in motion.

Many of these megaprojects have been pilloried by the media, environmental activists, and church-based critics of development in recent years, and at least in the Brazilian case the World Bank itself long ago publicly owned up to its mistakes. But Rich's belated take deserves notice because he draws heavily on internal Bank documents.

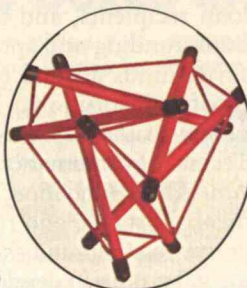
End-of-the-Line Thinking

Rich maintains that in the short term the best strategy for reinventing the Bank is to lighten the debt burden and trade barriers that now enslave so many Bank

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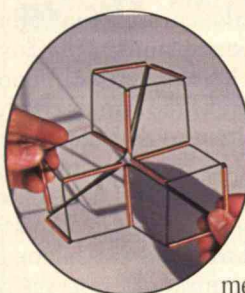
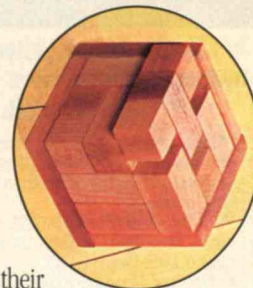
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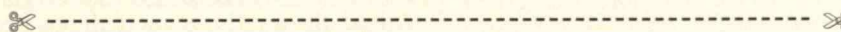


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REVIEWS

loan recipients, and then to decrease Bank funding and spread some of the saved funds around to smaller, more flexible institutions. For models, he points to the U.S.-based Appropriate Technology International and the Inter-American Foundation, which give technical assistance and relatively modest grants to communities and nongovernmental groups in developing nations.

Yet even though Rich doubts that the Bank will take these reformist steps, he proposes far more radical ones for the long term. He seconds other environmentalists' call for a permanent "independent appeals commission" that would channel complaints about environmental and human abuses to Bank directors. He thinks the Bank's charter should be rewritten so that the institution is hardwired to promote social equity, human rights, and democracy along with economic welfare. And he wants the Bank to spend \$10 billion of its \$18.5 billion in liquid reserves on grants to the poorest debt-strapped countries. If it can't or won't, says Rich, its funders should withdraw support and force it out of business.

End-of-the-line thinking like this underscores the urgency of the reforms called for in *Mortgaging the Earth*. And indeed, those reforms are both practical and long overdue. Many besides Rich who monitor the Bank in Washington and in the field seem fed up. Also, as Rich points out, nongovernmental groups around the world are coalescing to challenge Bank policies and projects.

On the other hand, Rich's antiestablishment sentiments may in 50 years seem almost as naive as the simple idea of progress without a price does now. Given that some environmental issues affect several communities or even several nations—and given that the Bank has long set the tone and pace of development in much of the world—trying to make this institution a force for positive change seems wiser than trying to divest it of its easily abused power.

Another problem is that though Rich is a tireless researcher and astute observer, he is not a practiced historian.

The book's long chapter on the rise of the ideas of progress and development bumps along from one great man to the next, and the narrative turns disappointingly anecdotal when it reaches the twentieth century. Nor does Rich seem interested in playing fair by journalistic standards. Stabs at stating the Bank's side of the story total no more than 10 scattered and mostly rhetorical paragraphs. Reciting more of the conventional wisdom about the Bank's self-proclaimed successes wouldn't have hurt the author's David vs. Goliath case.

More important, dissent and self-criticism within the Bank deserve more attention than Rich gives them. He touts the findings of the so-called Morse Commission, which in 1991 found the Bank's environmental performance on the controversial Sardar Sarovar project "grossly delinquent," but doesn't make enough of the fact that the grilling was an inside job, initiated by then outgoing president Barber Conable. Similarly, the Wapenhans Report—which showed that by 1991, 37.5 percent of Bank loans failed to meet the conditions placed on them—revealed both egregious abuses of the public trust and at least some willingness within the Bank to come clean.

Still, Rich's game is not academics or journalism but politics. In this arena, *Mortgaging the Earth* frames a vitally important debate and moves it out of the small community of World Bank employees, associates, funders, and critics and into the larger one where development projects too often uproot communities and siphon away natural resources while demoralizing poverty lives on. Already, the dust Rich has kicked up has sifted into the debate on how Congress should handle the \$850 million in U.S. funds overdue to the Bank and, more generally, on what the U.S. role as a Bank director should be in setting this powerful institution's lending agenda and priorities. ■

KATHLEEN COURRIER is the director of the publishing program at the World Resources Institute, based in Washington, D.C.

HISTORICAL DIAGNOSES

I mostly enjoyed Robert Finn's thoughtful, comprehensive review of my new book, *Seized: Temporal Lobe Epilepsy as a Medical, Historical, and Artistic Phenomenon*, in the February/March issue. But Finn made a few errors. He referred to other forms of epilepsy as being "more common" than temporal lobe epilepsy, when TLE is in fact the most common form of epilepsy among adults, afflicting roughly 1 million Americans today. (Among children, grand mal is the most common seizure type.)

Also, I did not "diagnose" TLE in historical figures, as Finn maintains. As a journalist—not a physician—I would be presumptuous, at the very least, in diagnosing any disorder. Every diagnosis of TLE discussed in *Seized* was made by a physician. Dostoevsky, van Gogh, and Flaubert, for instance, were all diagnosed in their lifetimes by their doctors. In the cases of more distant historical figures, such as Saint Paul, Saint Joan, and Moses, the diagnosis of TLE was made by a doctor in a taped interview with me, in a journal article, or in a book.

EVE LAPLANTE
Boston, Mass

ROAD WARRIORS

In "Cars, Civilization, and World Peace" (*TR*, May/June 1994) Thomas Magliozzi fails to keep in mind that apprehending a macho driver at the wheel of an overpowered car is fraught with danger, for vehicles are not the only "great equalizer"—handguns are another. I see a positive correlation between the ownership of powerful cars and the ownership of handguns: both provide a sense of power to the powerless. Magliozzi's attempt to have these aggressive drivers arrested could well lead him to an early and violent death. I would not raise a finger against arrogant drivers, however ill-behaved they were. I value my life too much.

ANTHONY P. HAYS
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Phenomena

BY DAVID BRITTAN

MY MIND EXPLORES THE UNIVERSE



Mr. B. is an amiable old gent who lives in Nevada, where he enjoys playing blackjack and reading the Bible. Oh, yes, he's also designing a starship. Most of the technical details are well in hand (the ship will run on "Einstein's mass-energy"), but a few hurdles remain. One problem is the size of the cathodes—"as big as buckets!" Another is the estimated \$50 million cost of building such a craft. "Just WHERE are we going to get THAT kind of money?" Mr. B. laments. The question is not merely academic: without a starship, he might never return to his native Saturn.

In letters that run to five or six pages—single-spaced and printed on both sides, with no margins to speak of—Mr. B. has been regaling one of *Technology Review's* editors with his insights and theories at least once a month, and sometimes twice in the same day, for half a year now. It is a one-sided correspondence. With no encouragement whatever, Mr. B. is glad to share his memories of King Arthur, by whom he was personally knighted, or his discovery of the four types of inertia—"grams, torpors, torpids, and photas"—or his views on the value of money, which, by a complex chain of reasoning that has to do with the global

distribution of sunshine, works out to 25 cents per person per day. Throughout it all, references to the Book of Revelation throb persistently.

Mr. B.'s correspondence is unique only in its particulars. We receive dozens of such letters a year, each setting forth a view of reality that no one but the sender can fully grasp. As a magazine of science and technology, we seem to be a magnet for alternative cosmologies, disproofs of relativity, unorthodox theories of gravitation, perpetual-motion schemes, and warnings of global catastrophe. Ms. K. writes: "I smelled something totally *unknown* to me capable of destroying human life. Using a handbook of physics and chemistry, can you help me quickly identify it before a system is destroyed? It smells sweet and quickly makes a human faint. Hurry." A proposal for "a better way to launch payloads into space" champions the little-known concept of "gyrothrust," wherein gyroscopes tilted at a certain angle can counteract the pull of gravity. It is followed up by a note that says, "Upon closer examination I believe that such a motor would not work." Then there's the bulletin about the "Bejing flue" epidemic that was supposed to kill millions of Americans infected with AIDS by the Russians; the appointed month came and went.

Often, the letters are written in a frenzy of productivity, ideas for new inventions spilling forth like coins from a lucky slot machine. After one such binge—ranging freely from solutions to the riddle of the pyramids to plans for sterilizing sewage with "atomic light"—a correspondent signs off: "My body spends most of its time in this room, but my mind explores the universe."

Judging by the idiosyncratic literature amassing in our file cabinets, countless other minds are on a similar journey. But

where are they coming from, and why does their itinerary so often include *Technology Review*?

I recently showed a sample of these letters to James Ellison, a prominent Boston-area psychiatrist. Leafing through the stack of mail—some handwritten, with words capitalized and underscored at random, some flamboyantly word-processed or adorned with cut-out pictures—Ellison cautioned that nothing definitive could be inferred from a letter. His diagnoses tended to be broad: "It could be mania, it could be schizophrenia, or it could be someone who's just good and drunk."

Even so, patterns began to emerge. The sheer output of many letter writers—a quirk known as hypergraphia—made Ellison think of temporal lobe epilepsy. Seizures caused by this condition can spark intense bursts of expressive activity. They can also bring on a cosmological or ultrareligious turn of mind. "Often," said Ellison, "you see a focus on the profound questions of life—right and wrong, morality, divinity, justice, that sort of stuff—but going on at great length, to the point where it can be kind of overwhelming. Sometimes people like that pursue careers as writers." Or possibly as starship designers who pen 5,000-word letters and cite verses from the Apocalypse.

The tenacity with which Mr. B. clings to his odd ideas is a trait common to many of our cosmic explorers. According to Ellison, delusional beliefs can restore order to lives that have been fractured by mental illness. "Such people often go through a period of confusion that then subsides as their delusion crystallizes and they become reorganized around their false belief system," he told me. "It gives them a new meaning, whether it be that the FCC is torturing them by broadcasting voices into their head or that they are the

Antichrist. It eases the turmoil of Who am I, What am I?"

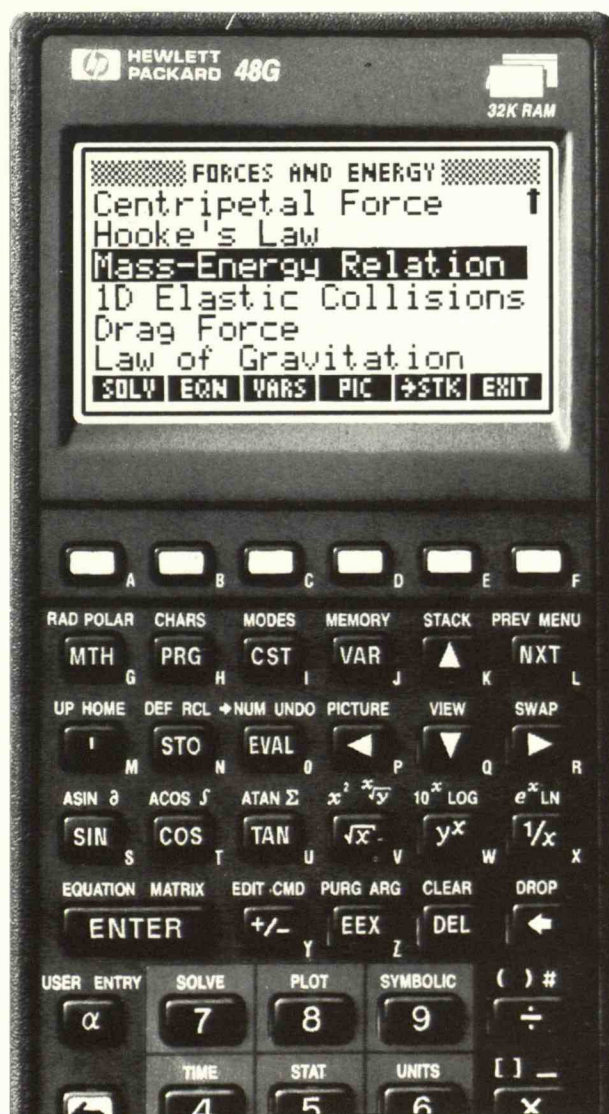
If our eccentric letters are any indication, people piece their psyches back together in ingenious ways. Ellison particularly admired the resourcefulness of Mr. O., who cures unpleasant sensations with little gadgets built from household ingredients. Using only a wire coil, a thumbtack, and a cigarette (nonfilter), Mr. O. managed to block out "malicious telepathy." A device consisting of crystals, an AA battery, and a jar of flat beer stopped "unexplained pain" in his groin.

Like many of these correspondents, Mr. O. has relentless faith in the technological fix. I wondered aloud whether delusions often crystallize around science and technology—whether, in fact, publications like *Technology Review* draw a disproportionate amount of mail from the outer limits. Probably not, according to Ellison. "Such people develop their own cosmology that includes elements of whatever they hear about or know about. The ones who write to *Rolling Stone* have delusions about rock stars." So what do these individuals want with us, or with any magazine? Perhaps only to be heard. "Everybody has a story to tell," said Ellison. "Writing a letter to the editor can be extremely validating and healing. There is a wish to be acknowledged as a person with an important idea to share."

Alone once again with my collection of oddities, I ask how well we have answered the writers' call for acknowledgement. Not very, I'm afraid. Most of the letters have met only with embarrassed silence. A few have prompted a sterile thank-you and a quick brush-off—which may be the best we can do without gaining an interstellar pen-pal for life. But I might from now on add the following postscript: "I like the way your mind works, and I hope life is treating you fairly." ■

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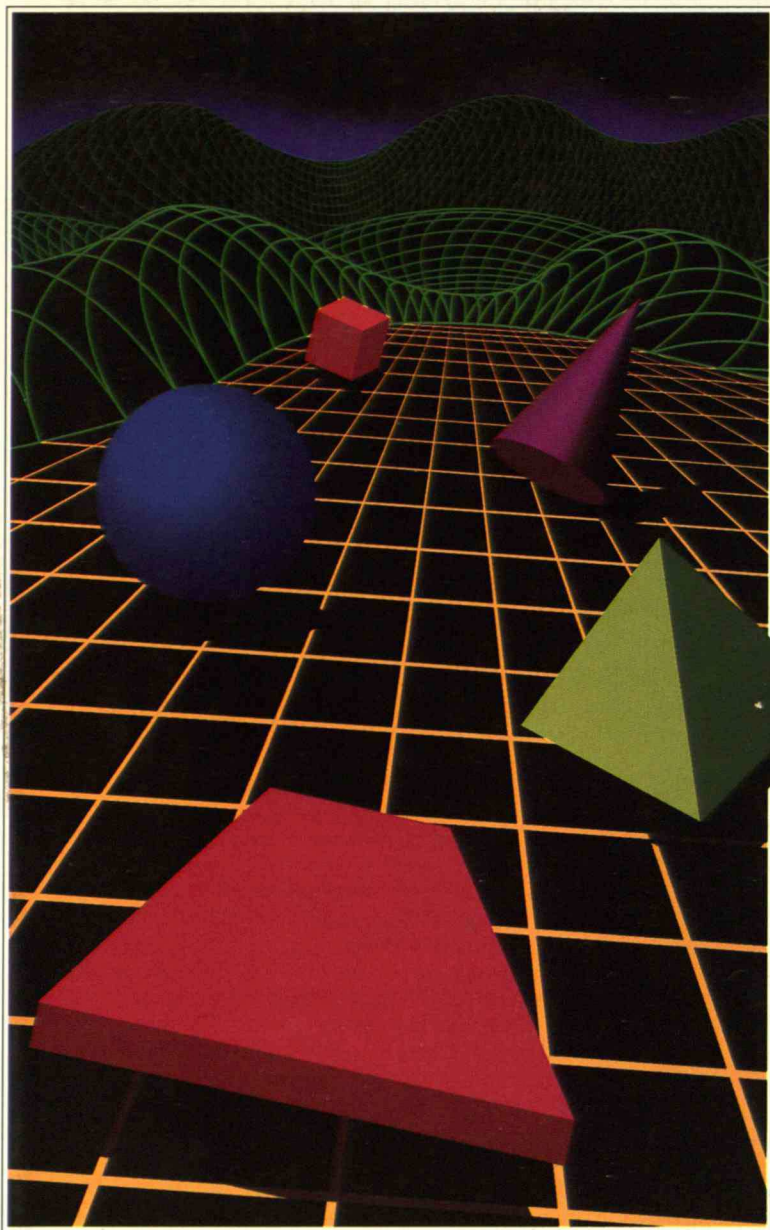
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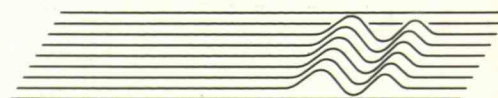
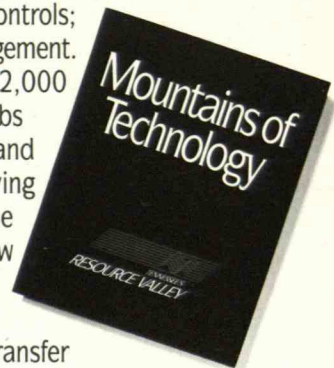
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